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NATIONAL DAM SAFETY PROGRAM. HEATERS POND DAM (NJ00795), WALLKI--ETC(U)
MAY 81 R J MCDERMOTT, J E GRIBBON DACW61-79-C-0011
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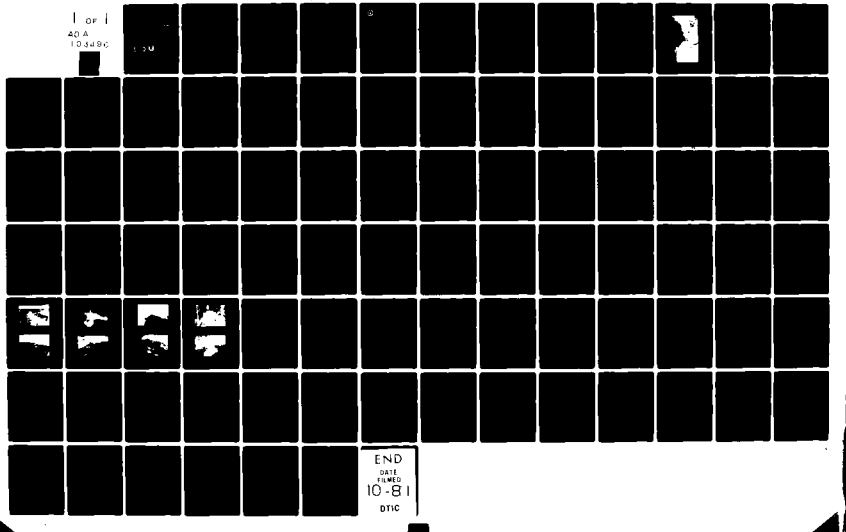

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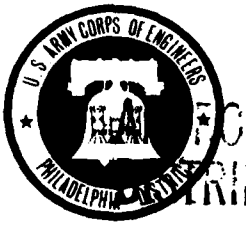
WALLKILL RIVER BASIN
SAWMILL BROOK, SUSSEX COUNTY
NEW JERSEY

HEATERS POND DAM
NJ00795

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM



DEPARTMENT OF THE ARMY
Philadelphia District
Corps of Engineers
Philadelphia, Pennsylvania

MAY 1981

REPT. NO: DAEN/NAP-53842/NJ00795-81/05

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

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18. SUPPLEMENTARY NOTES

Copies are obtainable from National Technical Information Service, Springfield, Virginia 22151.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Dams
Embankments
Visual Inspection
Structural Analysis
National Dam Safety Program
Heaters Pond Dam, N.J.
Spillways

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report cites results of a technical investigation as to the dam's adequacy. The inspection and evaluation of the dam is as prescribed by the National Dam Inspection Act, Public Law 92-367. The technical investigation includes visual inspection, review of available design and construction records, and preliminary structural and hydraulic and hydrologic calculations, as applicable. An assessment of the dam's general condition is included in the report.

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DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
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IN REPLY REFER TO
NAPEN-N

21 JUL 1981

Honorable Brendan T. Byrne
Governor of New Jersey
Trenton, New Jersey 08621

Dear Governor Byrne:

Inclosed is the Phase I Inspection Report for Heaters Pond Dam in Sussex County, New Jersey which has been prepared under authorization of the Dam Inspection Act, Public Law 92-367. A brief assessment of the dam's condition is given in the front of the report.

Based on visual inspection, available records, calculations and past operational performance, Heaters Pond Dam, initially listed as a high hazard potential structure, but reduced to a significant hazard potential structure as a result of this inspection, is judged to be in fair overall condition. The dam's spillway is considered inadequate because a flow equivalent to 11 percent of the Spillway Design Flood (SDF) would cause the dam to be overtopped. To ensure adequacy of the structure, the following actions, as a minimum, are recommended:

a. The spillway's adequacy should be determined by a qualified professional consultant engaged by the owner using more sophisticated methods, procedures and studies within six months from the date of approval of this report. Within three months of the consultant's findings remedial measures to ensure spillway adequacy should be initiated.

b. Within six months from the date of approval of this report the owner should engage a qualified professional consultant to monitor the possible seepage in order to detect any changes in condition.

c. Within six months from the date of approval of this report the trees and adverse vegetation should be removed from the embankment.

d. The owner should develop written operating procedures and a periodic maintenance plan to ensure the safety of the dam, within one year from the date of approval of this report.

e. An emergency action plan and warning system should be developed which outlines actions to be taken by the owner to minimize the downstream effects of an emergency at the dam within six months from the date of approval of this report.

A copy of the report is being furnished to Mr. Dirk C. Hofman, New Jersey Department of Environmental Protection, the designated State Office contact for this program. Within five days of the date of this letter, a copy will also be sent to Congressman Courter of the Thirteenth District. Under the provision of the Freedom of Information Act, the inspection report will be subject to release by this office, upon request, five days after the date of this letter.

Additional copies of this report may be obtained from the National Technical Information Services (NTIS), Springfield, Virginia 22161 at a reasonable cost. Please allow four to six weeks from the date of this letter for NTIS to have copies of the report available.

An important aspect of the Dam Inspection Program will be the implementation of the recommendations made as a result of the inspection. We accordingly request that we be advised of proposed actions taken by the State to implement our recommendations.

Sincerely,

Roger Baldwin

1 Incl
As stated

ROGER L. BALDWIN
Lieutenant Colonel, Corps of Engineers
Commander and District Engineer

Copies furnished:
Mr. Dirk C. Hofman, P.E., Deputy Director
Division of Water Resources
N.J. Dept. of Environmental Protection
P.O. Box CN029
Trenton, NJ 08625

Mr. John O'Dowd, Acting Chief
Bureau of Flood Plain Regulation
Division of Water Resources
N.J. Dept. of Environmental Protection
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Trenton, NJ 08625

HEATERS POND DAM (NJ000795)

CORPS OF ENGINEERS ASSESSMENT OF GENERAL CONDITIONS

This dam was inspected on 19 December 1980 by Storch Engineers, under contract to the State of New Jersey. The State, under agreement with the U.S. Army Engineer District, Philadelphia, had this inspection performed in accordance with the National Dam Inspection Act, Public Law 92-367.

Heaters Pond Dam, initially listed as a high hazard potential structure, but reduced to a significant hazard potential structure as a result of this inspection, is judged to be in fair overall condition. The dam's spillway is considered inadequate because a flow equivalent to 11 percent of the Spillway Design Flood (SDF) would cause the dam to be overtopped. To ensure adequacy of the structure, the following actions, as a minimum, are recommended:

a. The spillway's adequacy should be determined by a qualified professional consultant engaged by the owner using more sophisticated methods, procedures and studies within six months from the date of approval of this report. Within three months of the consultant's findings remedial measures to ensure spillway adequacy should be initiated.

b. Within six months from the date of approval of this report the owner should engage a qualified professional consultant to monitor the possible seepage in order to detect any changes in condition.

c. Within six months from the date of approval of this report the trees and adverse vegetation should be removed from the embankment.

d. The owner should develop written operating procedures and a periodic maintenance plan to ensure the safety of the dam, within one year from the date of approval of this report.

e. An emergency action plan and warning system should be developed which outlines actions to be taken by the owner to minimize the downstream effects of an emergency at the dam within six months from the date of approval of this report.

APPROVED: Roger Baldwin

ROGER L. BALDWIN
Lieutenant Colonel, Corps of Engineers
Commander and District Engineer

DATE: 31 July 81

PHASE I REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam:	Heaters Pond Dam, NJ00795
State Located:	New Jersey
County Located:	Sussex
Drainage Basin:	Wallkill River
Stream:	Sawmill Brook
Date of Inspection:	December 19, 1980
	May 1, 1981

Assessment of General Condition of Dam

Based on visual inspection, past operational performance and Phase I engineering analyses, the dam is assessed as being in fair overall condition.

Based on investigations of the downstream flood plain made in connection with this report, it is recommended that the hazard potential classification be downgraded from high to significant hazard.

Hydraulic and hydrologic analyses indicate that the spillway is inadequate. Discharge capacity of the spillway is not sufficient to pass the designated spillay design flood (SDF) without an overtopping of the dam. (The SDF for Heaters Pond Dam is equal to one-half the probable maximum flood.) The spillway is capable of passing approximately 5 percent of the probable maximum flood or 10 percent of the SDF. Therefore, the owner should engage a professional engineer experienced in the design and construction of dams in the near future to perform more accurate hydraulic and hydrologic analyses relating to spillway capacity. Based on the findings of the analyses, the need for, and type of remedial measures should be determined and then implemented.

The owner should, in the near future, develop an emergency action plan together with an effective warning system outlining actions to be taken by the operator to minimize downstream effects of an emergency at the dam.

Standing water indicating possible seepage was observed at two locations at the toe of dam. Arrangements should be made in the near future to monitor the possible seepage in order to detect any changes in condition. The monitoring should be performed by a professional engineer experienced in the design and construction of dams.

In addition, it is recommended that, in the near future, all trees and adverse vegetation should be removed from the embankments.

In the future, the owner of the dam should develop written operating procedures and a periodic maintenance plan to ensure the safety of the dam.

Richard J. McDermott, P.E.

John E. Gribbin, P.E.

OVERVIEW - HEATERS POND DAM

20 JANUARY 1981

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PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. It is important to note that the condition of dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that the unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydraulic and hydrologic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydraulic and hydrologic studies, considering the size of the dam, its general condition and the downstream damage potential.

PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

HEATERS POND DAM, I.D. NJ00795

SECTION 1: PROJECT INFORMATION

1.1 General

a. Authority

Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The Division of Water Resources of the New Jersey Department of Environmental Protection (NJDEP) in cooperation with the Philadelphia District of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the State of New Jersey. Storch Engineers has been retained by the NJDEP to inspect and report on a selected group of these dams. The NJDEP is under agreement with the Philadelphia District of the Corps of Engineers.

b. Purpose of Inspection

The visual inspections of Heaters Pond Dam were made on December 19, 1980 and May 1, 1981. The purpose of the inspections was to make a general assessment of the structural integrity and operational adequacy of the dam structure and its appurtenances.

1.2 Description of Project

a. Description

Heaters Pond Dam is an earth dam with a central concrete structure serving as spillway and outlet works. The spillway is designed to function in two stages, the primary stage consisting of a sharp crested weir and the secondary stage consisting of a concrete weir with trapezoidal section. The sharp crested weir is formed by timber stoplogs which also comprise the outlet works for the dam. In addition, a low area of the lake shore adjacent to the left end of dam serves as an auxiliary spillway.

The earth embankment section of the dam has a crest width of 8 feet and downstream slope of 4 horizontal to 1 vertical and extends for a distance of 210 feet left of the spillway. A concrete wall extends about 89 feet to the right of the spillway.

The elevation of the primary spillway crest is 960.3 National Geodetic Vertical Datum (N.G.V.D.) while that of the secondary spillway is 961.3. The auxiliary spillway crest is at elevation 961.2. The crest of dam is at elevation 962.3 and the downstream channel bed elevation is 954.5. The overall length of the dam is 324 feet and its height is 7.9 feet.

The downstream channel in the vicinity of the dam is lined with limestone riprap.

b. Location

Heaters Pond Dam is located in the Borough of Ogdensburg, Sussex County, New Jersey. It impounds a recreational lake used as the municipal swimming area adjacent to Edison Avenue. Principal access to the dam is via Edison Avenue approximately one mile south of its intersection with Route 517. The dam is located on the Sawmill Brook; tributary of the Wallkill River.

c. Size and Hazard Classification

The dam is classified in accordance with criteria presented in "Recommended Guidelines for Safety Inspection of Dams" published by the U.S. Army Corps of Engineers. Size categories consist of Small, Intermediate and Large while hazard categories are designated as Low, Significant and High.

Size Classification: Heaters Pond Dam is classified as "Small" size since its maximum storage volume is 133 acre-feet (which is less than 1000 acre-feet) and its height is 7.9 feet (which is less than 40 feet).

Hazard Classification: Visual inspection of the downstream flood plain of the dam together with breach analysis indicate that failure of the dam could inundate the dwelling located 800 feet from the dam. In addition, visual inspection and breach analysis indicate that dam failure during a storm equivalent to the SDF would not cause inundation of additional dwellings located between 3600 and 7200 feet from the dam, although it could cause property damage. Loss of more than a few lives is not anticipated. Accordingly, Heaters Pond Dam is classified as "Significant" hazard.

d. Ownership

Heaters Pond Dam is owned and operated by the Borough of Ogdensburg, 14 Highland Avenue, Ogdensburg, New Jersey 07439.

e. Purpose of Dam

The purpose of the dam is the impoundment of a lake used for recreation. During the summer months the lake is used as a municipal swimming facility.

f. Design and Construction History

Reportedly, Heaters Pond Dam was constructed around 1910 for the purpose of supplying water to a now defunct sawmill. Following a 1955 hurricane, the crest of the dam was raised approximately three feet and the spillway was modified. In 1979, spillway and embankment repairs were performed by the Borough of Ogdensburg.

g. Normal Operational Procedures

The dam and appurtenances are operated and maintained by the Borough of Ogdensburg.

Reportedly, the stoplogs are removed during periods of heavy rain. The lake was last drawn down in 1978 for the purpose of maintaining the swimming area and repairing any damaged stop logs. This maintenance is reportedly performed every two or three years.

1.3 Pertinent Data

a. Drainage Area	1.35 square miles

b. Discharge at Damsite

Maximum flood at damsite	Unknown
Outlet works at pool elevation	10 cfs
Spillway capacity at top of dam	52 cfs
Auxiliary spillway at top of dam	45 cfs
Total discharge at top of dam	97 cfs

c. Elevation (N.G.V.D.)

Top of dam	962.3
Maximum pool-design surcharge	964.5
Primary spillway crest	960.3

Secondary spillway crest	961.3
Auxiliary spillway crest	961.2
Stream bed at toe of dam	954.4
Maximum tailwater	958.0 (Estimated)

d. Reservoir

Length of maximum pool	4400 feet (Estimated)
Length of recreation pool	4200 feet (Scaled)

e. Storage (Acre-feet)

Recreation pool	55
Design surcharge	240
Top of dam	133

f. Reservoir Surface (acres)

Top of dam	47 (Estimated)
Maximum pool - design surcharge	58 (Estimated)
Recreation pool	38.1

g. Dam

Type	Earthfill
Length	324 feet
Height	7.9 feet
Sideslopes - Upstream	3 horiz. to 1 vert.
- Downstream	4 horiz. to 1 vert.
Zoning	Unknown
Impervious core	Unknown
Cutoff	Unknown
Grout curtain	Unknown

h. Diversion and Regulating Tunnel	N.A.

i. Spillway

Type	Two-staged Weir
Length of primary weir	3.1 feet
Length of secondary weir	5.0 feet
Primary crest elevation	960.3
Secondary crest elevation	961.3
Gates	Timber Stoplogs Comprise Primary Weir
Upstream channel	N.A.
Downstream channel	Natural stream, riprapped

j. Auxiliary Spillway

Type	Irregular low area in lake shore adjacent to dam
Length of weir	15 feet
Crest elevation	961.2
Gates	N.A.
Approach Channel	N.A.
Discharge Channel	Discharge flows into swamp area on downstream-side of embankment

k. Regulating Outlet

Timber stoplogs 3.1 feet long fitted in spillway structure.

SECTION 2: ENGINEERING DATA

2.1 Design

No plans or calculations pertaining to the original construction of the dam or the 1955 raising of the crest could be obtained. Drawings relating to the 1979 repair of the embankment and spillway are available in the files of the Borough of Ogdensburg and at the offices of the Borough Engineer, Harold E. Pellow and Associates, RD#1, Box 2D, Augusta, New Jersey.

In addition, a soils report by Joseph Ward Assoicates for the 1979 dam repair reportedly is available in the files of the Borough of Ogdensburg.

2.2 Construction

No data or reports pertaining to the construction of the dam are available.

2.3 Operation

Reportedly, informal maintenance reports are on file with the Borough of Ogdensburg.

2.4 Evaluation

a. Availability

Available engineering data is limited to that which is on file with the Borough of Odgensburg and the Borough Engineer. These files contain drawings relating to the repairs in 1979.

b. Adequacy

Available enginering data pertaining to Heaters Pond Dam is of limited assistance to the performance of a Phase I evaluation. A list of absent information is included in paragraph 7.1.b.

c. Validity

Most information that could be verified was found to be valid within a reasonable allowance for error.

SECTION 3: VISUAL INSPECTION

3.1 Findings

a. General

The inspections of Heaters Pond Dam were performed on December 19, 1980 and May 1, 1981, by staff members of Storch Engineers. A copy of the visual inspection check list is contained in Appendix 1. The following procedures were employed for the inspections:

1) The embankment of the dam, appurtenant structures and adjacent areas were examined.
2) The embankment and accessible appurtenant structures were measured and key elevations determined by surveyor's level.
3) The embankment, appurtenant structures and adjacent areas were photographed.
4) The downstream flood plain was toured to evaluate downstream development and restricting structures.

b. Dam

The concrete wall located to the right of the spillway was in satisfactory condition. The crest of the left embankment was generally level and grass covered with some small trees on the upstream and downstream faces. A swampy area containing standing water was located at the downstream toe of the embankment near its left end. Portions of the standing water were not ice covered whereas the lake was frozen. In addition, an area of standing water was observed at the toe of embankment adjacent to the left side of the downstream channel.

A low area in the lake shore was observed adjacent to a boulder located at the left end of the embankment. The low area appeared to function as an auxiliary spillway.

c. Spillway Structure

The condition of the concrete spillway was generally satisfactory and the timber stoplogs also appeared to be in satisfactory condition.

d. Reservoir Area

The impoundment of the dam is 4200 feet long with a width varying from 100 to 900 feet. It is surrounded by a forested area which extends to the shoreline and its shore slopes are generally moderate. The only structure observed on the lake was a local residential access bridge near the middle of the impoundment.

e. Downstream Channel

The spillway discharges into the Sawmill Brook which is a well-graded, riprap lined channel in the vicinity of the dam. The riprap appeared to be adequate in stone size and coverage. Between the dam and Route 517, approximately 3600 feet downstream, the downstream channel has very high rocky side slopes resembling a gorge. From Route 517, the channel continues through two residential subdivisions to its confluence with the Wallkill River approximately 7200 feet downstream from the dam.

SECTION 4: OPERATIONAL PROCEDURES

4.1 Procedures

The level of water in Heaters Pond is regulated by discharge over the spillway and auxiliary spillway. The primary weir (stoplogs) of the spillway can be used to drain the lake or to augment the discharge capacity of the spillway.

Reportedly, if considered necessary, the stoplogs are pulled during heavy storms by personnel of the Borough of Ogdensburg.

The most recent drawdown of the lake occurred 2 years ago when improvements were made to the spillway and maintenance was performed on the beach area. It was reported that 3 to 4 days were required to drain the lake completely.

4.2 Maintenance of the Dam

Reportedly, maintenance is performed only on an "as needed" basis. The most recent maintenance reportedly was performed during 1979 when the spillway was modified and riprap was placed on the downstream channel.

4.3 Maintenance of Operating Facilities

The outlet works for the dam is maintained on an "as needed" basis. It was reportedly serviced 2 years ago when the spillway was modified and damaged stoplogs were replaced.

4.4 Description of Warning System

Reportedly, no automatic warning system is currently in use for the dam, although the Borough of Ogdensburg visually monitors the lake level during periods of heavy rain.

4.5 Evaluation of Operational Adequacy

The operation of the old dam had not been successful to the extent that the dam reporedly overtopped and breached in 1955. Reportedly, no damage to downstream structures occurred during the overtopping of 1955. The operation of the present dam has been successful to the extent that no overtopping has been reported since the dam was reconstructed in 1955.

Maintenance appears to be generally adequate, although trees and weeds on the embankment have not been removed.

SECTION 5: HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design Data

The quantity of storm water runoff that the spillway should be able to handle is based on the size and hazard classification of the dam. This runoff quantity, called the Spillway Design Flood (SDF) is described in terms of return frequency or Probable Maximum Flood (PMF) depending on the extent of the dam's size and potential hazard. According to the "Recommended Guidelines for Safety Inspection of Dams" published by the U.S. Army Corps of Engineers, the SDF for Heaters Pond Dam falls in a range of 100-year storm to 1/2 PMF. In this case the upper end of the range, 1/2 PMF, is chosen since the factors used to select hazard classification are among the more severe of those recommended for "Significant" hazard.

The SDF peak computed for Heaters Pond Dam is 1909 c.f.s. This value is derived from the SDF flood hydrograph computed by the use of the HEC-1-DAM Flood Hydrograph Computer Program using the Soil Conservation Service unit hydrograph method with curvilinear transformation. Hydrologic computations and computer output are contained in Appendix 4.

The spillway discharge rates were computed by the use of weir formaulae appropriate for the configurations of the spillway structure. The spillway discharge with lake level equal to the top of the dam was computed to be 52 c.f.s. Discharge through the auxiliary spillway (low area adjacent to dam) with lake level equal to the top of dam was computed to be 45 c.f.s. Therefore, total discharge with lake level equal to the top of dam was found to be 97 c.f.s. The SDF was routed through the dam by use of the HEC-1-DAM computer program using the modified Puls Method. In routing the SDF, it was found

that the dam crest would be overtopped by a depth of 2.2 feet. Accordingly, the subject spillway is assessed as being inadequate in accordance with criteria developed by the U.S. Army Corps of Engineers.

A dam breach analysis was then performed using a trapezoidal breach of 25 feet bottom length. The breach analysis indicates that dam failure from overtopping would cause inundation of one dwelling located about 800 feet downstream from the dam, but would not cause inundation of additional dwellings located in excess of 3600 feet from the dam. Dam breach computations are contained in Appendix 4.

b. Experience data

Reportedly, the dam has not been overtopped since it was reconstructed in 1955. Reportedly, no damage to downstream structures was reported during the overtopping of 1955.

c. Visual Observation

No evidence was found at the times of inspection that would indicate that the dam had been overtopped in recent years.

d. Overtopping Potential

As indicated in paragraph 5.1.a., a storm of magnitude equal to the SDF would cause overtopping of the dam to a height of 2.2 feet over the crest of the dam. The spillway is capable of passing approximately 10 percent of the SDF with lake level equal to the top of dam.

e. Drawdown Data

Drawdown of the lake is accomplished by removing stoplogs from the principal spillway. Total time for drawdown is estimated to be 3.2 days (See Appendix 4).

SECTION 6: STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

The dam appeared, at the times of inspection to be outwardly structurally sound with no evidence of cracks or distress. Possible seepage was observed at the toe of the dam to the left of the downstream channel and near the left end of the embankment.

b. Generalized Soils Description

The generalized soils description of the Heaters Pond Dam site consists of a narrow stream bed composed of recent alluvium extending northwards, and a ground Moraine formation of the Wisconsin glaciation surrounding the alluvium deposits.

This recent alluvium, bordering a sluggish stream, is mainly composed of silt and clay. In contrast, the glacial ground moraine is composed of coarse materials: silty sand, cobbles and boulders, derived from the nearby Byram gneissic bed rock as identified on the Geologic Map of New Jersey.

c. Design and Construction Data

The analysis of structral stability and construction data for the embankment are not available.

d. Operating Records

No operating records are available for the dam. The water level of Heaters Pond is not monitored.

e. Post-Construction Changes

No significant changes to the dam or area around the dam are known to have occurred since the repairs in 1979.

f. Seismic Stability

Heaters Pond Dam is located in Seismic Zone 1 as defined in "Recommended Guidelines for Safety Inspection of Dams" which is a zone of very low seismic activity. Experience indicates that dams in Seismic Zone 1 will have adequate stability under seismic loading conditions if they have adequate stability under static loading conditions. Heaters Pond Dam appeared to be stable under static loading conditions at the times of inspections.

SECTION 7: ASSESSMENT AND RECOMMENDATIONS

7.1 Dam Assessment

a. Safety

Based on hydraulic and hydrologic analyses outlined in Section 5 and Appendix 4, the spillway of Heaters Pond Dam is assessed as being inadequate. The spillway is not able to pass the SDF without an overtopping of the dam.

The embankment and concrete sections of the dam appeared, at the times of inspection, to be outwardly stable.

b. Adequacy of Information

Information sources for this report include 1) field inspection, 2) USGS quadrangle, 3) plans entitled "Heaters Pond Dam" prepared by Harold E. Pellow and Associates, and 4) consultation with personnel of the Borough of Ogdensburg. The information obtained is sufficient to allow a Phase I assessment as outlined in "Recommended Guidelines for Safety Inspection of Dams."

Some of the absent data are as follows:

1) Description of fill material for embankment.
2) Design computations and reports.
3) Inspection reports.
4) Construction progress reports.

c. Necessity for Additional Data/Evaluation

Although some data pertaining to Heaters Pond Dam are not available, additional data are not considered imperative for this Phase I evaluation.

7.2 Recommendations

a. Remedial Measures

Based on hydraulic and hydrologic analyses outlined in paragraph 5.1.a, the spillway is considered to be inadequate. It is therefore recommended that a professional engineer experienced in the design and construction of dams be engaged in the near future to perform more accurate hydraulic and hydrologic analyses relating to spillway capacity. Based on the findings of these analyses, the need for and type of remedial measures should be determined and then implemented.

The owner should, in the near future, develop an emergency action plan together with an effective warning system outlining actions to be taken by the operator to minimize downstream effects of an emergency at the dam.

In addition, it is recommended that, in the near future, all trees and adverse vegetation should be removed from the embankment.

b. Maintenance

In the future, the owner of the dam should develop writ .n operating procedures and a periodic maintenance plan to ensure the safety of the dam.

c. Additional Studies

Arrangements should be made in the near future to monitor the possible seepage in order to detect any changes in condition. The monitoring should be performed by a professional engineer experienced in the design and construction of dams.

PLATES

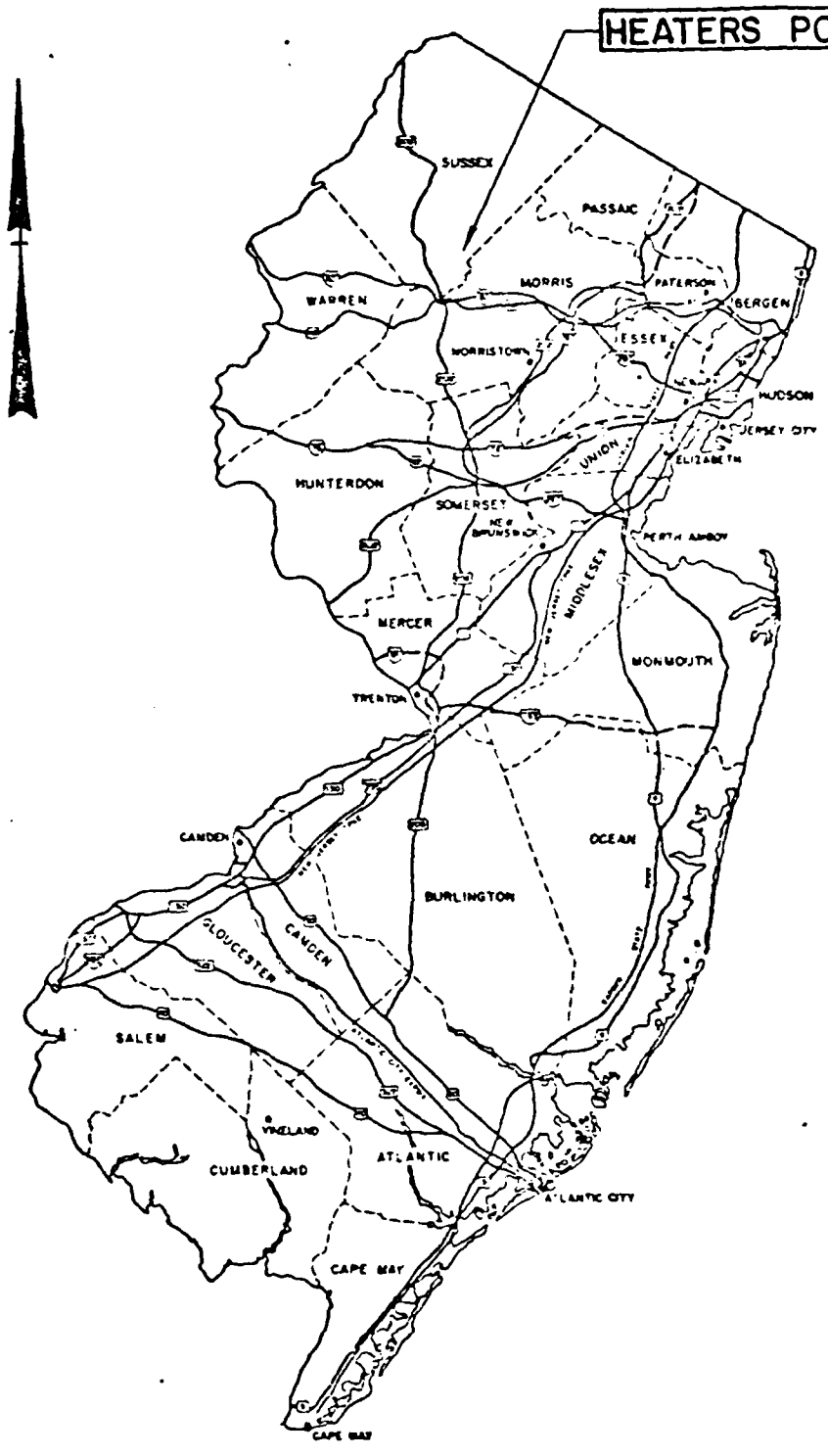
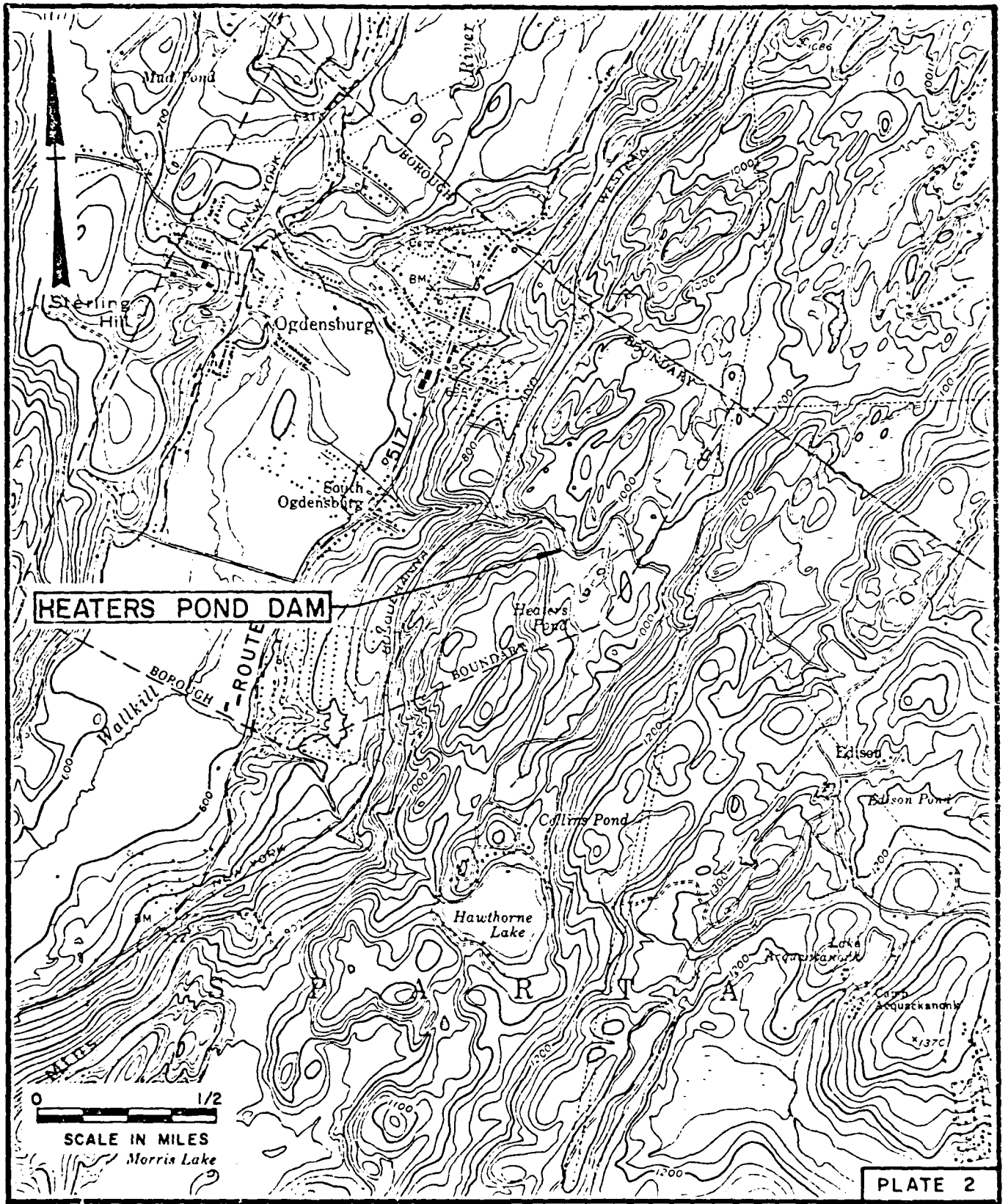


PLATE 1

STORCH ENGINEERS FLORHAM PARK, NEW JERSEY	INSPECTION AND EVALUATION OF DAMS KEY MAP HEATERS POND DAM
DIVISION OF WATER RESOURCES N.J. DEPT. OF ENVIR. PROTECTION TRENTON, NEW JERSEY	SCALE: NONE DATE: FEB. 1981



STORCH ENGINEERS
FLORHAM PARK, NEW JERSEY

DIVISION OF WATER RESOURCES
N.J. DEPT. OF ENVIR. PROTECTION
TRENTON, NEW JERSEY

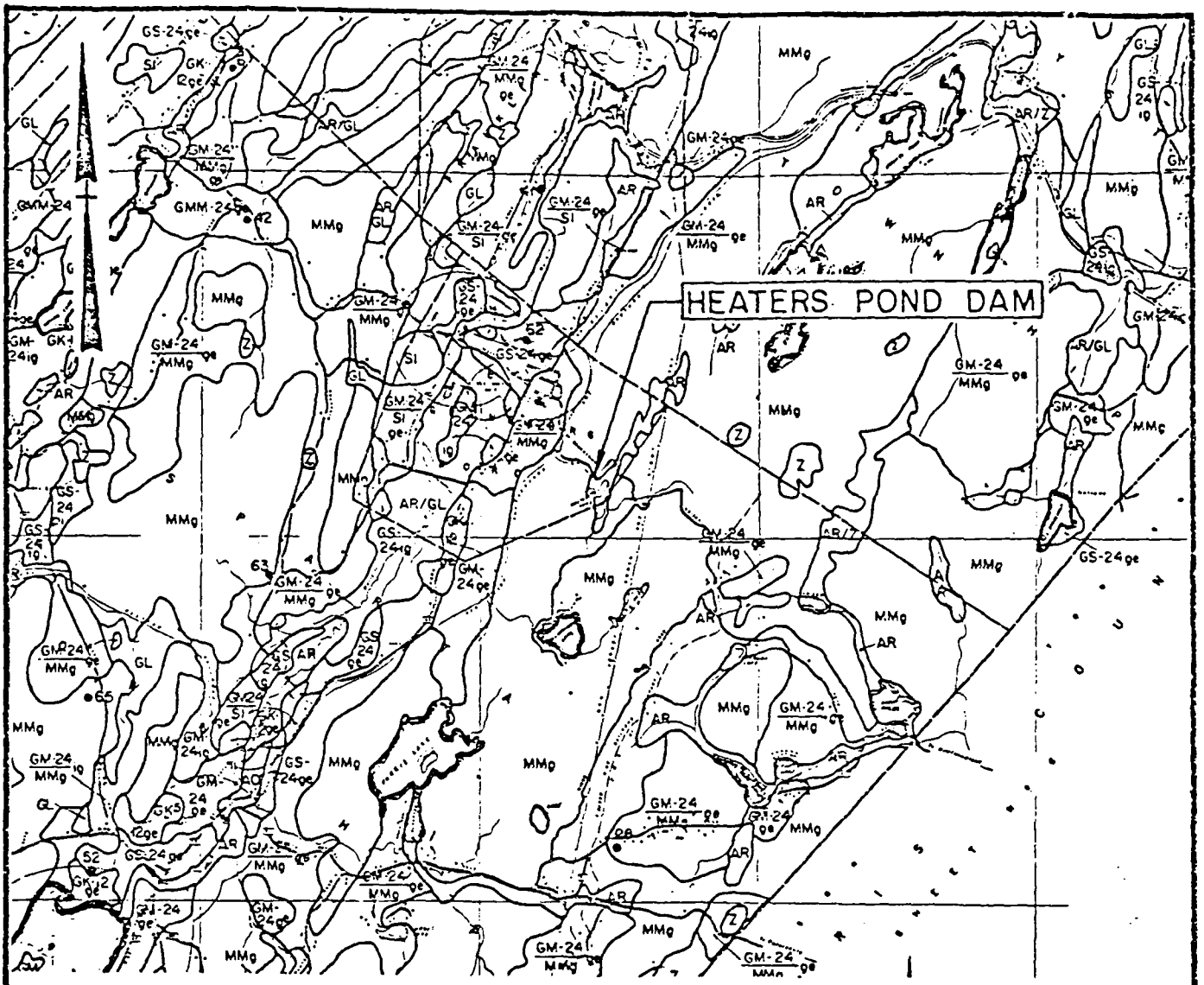
INSPECTION AND EVALUATION OF DAMS

VICINITY MAP

HEATERS POND DAM

SCALE: AS SHOWN

DATE: FEB. 1981



Legend

AR	Recent alluvium composed of stratified materials found adjacent to the present stream course.
GM-24/MMg	Shallow mantle of ground moraine composed of unconsolidated unstratified materials deposited during the Wisconsin Glacial stage overlying Byram Gneissic bedrock.
Note:	Information taken from Rutgers University, Soil Survey of New Jersey, Report No. 11, Sussex County, November 1953 and Geologic Map of New Jersey prepared by J.V. Lewis and H. Kummel 1910-1912, revised by H.B. Kummel 1931 and M. Johnson 1950.

PLATE 3

STORCH ENGINEERS
FLORHAM PARK, NEW JERSEY.

DIVISION OF WATER RESOURCES
N.J. DEPT. OF ENVIR. PROTECTION
TRENTON, NEW JERSEY

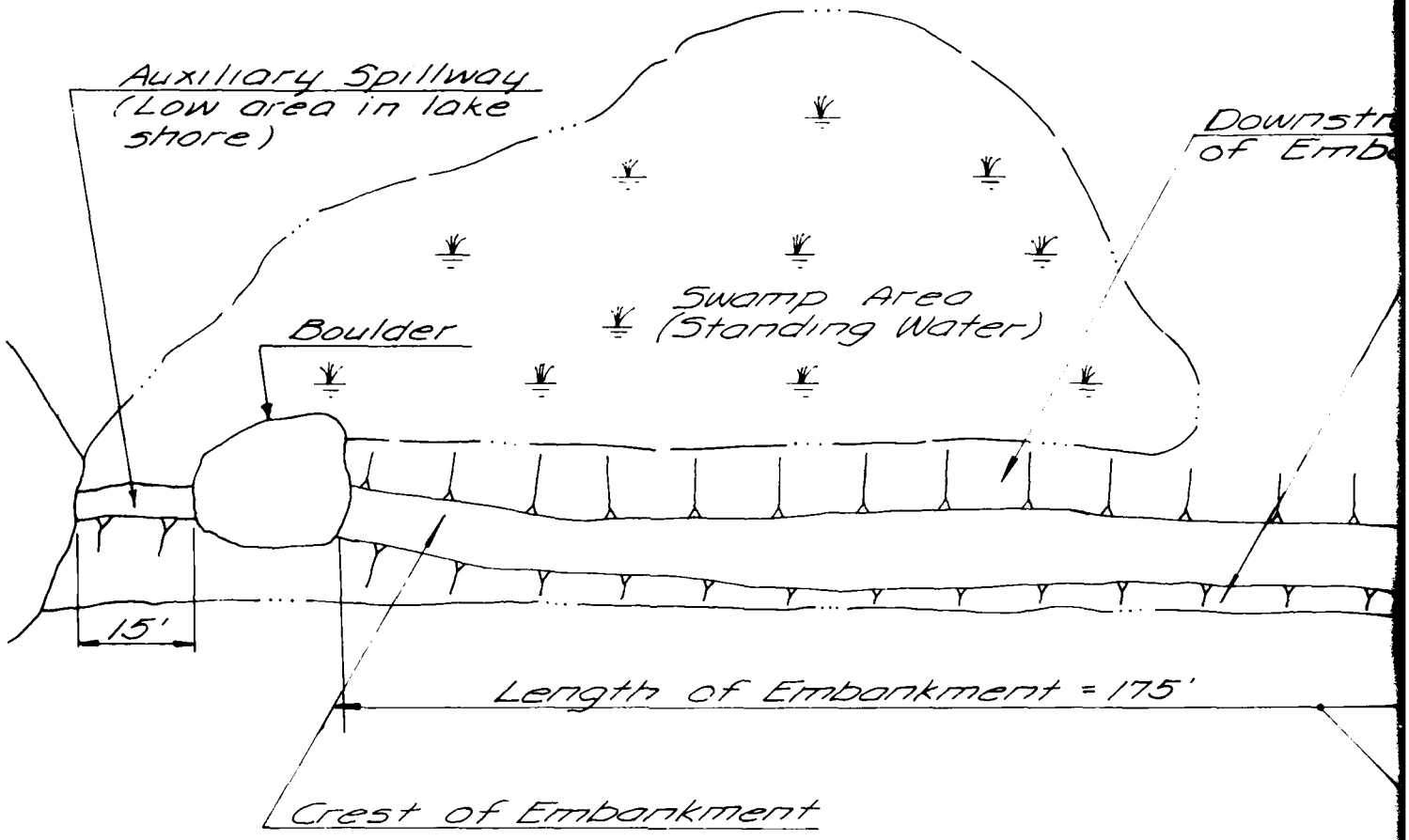
INSPECTION AND EVALUATION OF DAMS

SOIL MAP

HEATERS POND DAM

SCALE: NONE

DATE: FEB. 1981



HEATERS POND

NOTE
Information taken from plans titled "Heaters Pond Dam" prepared by Harold E. Pellow, P.E. & L.S. dated 8/21/79 and field inspection December 19, 1980.

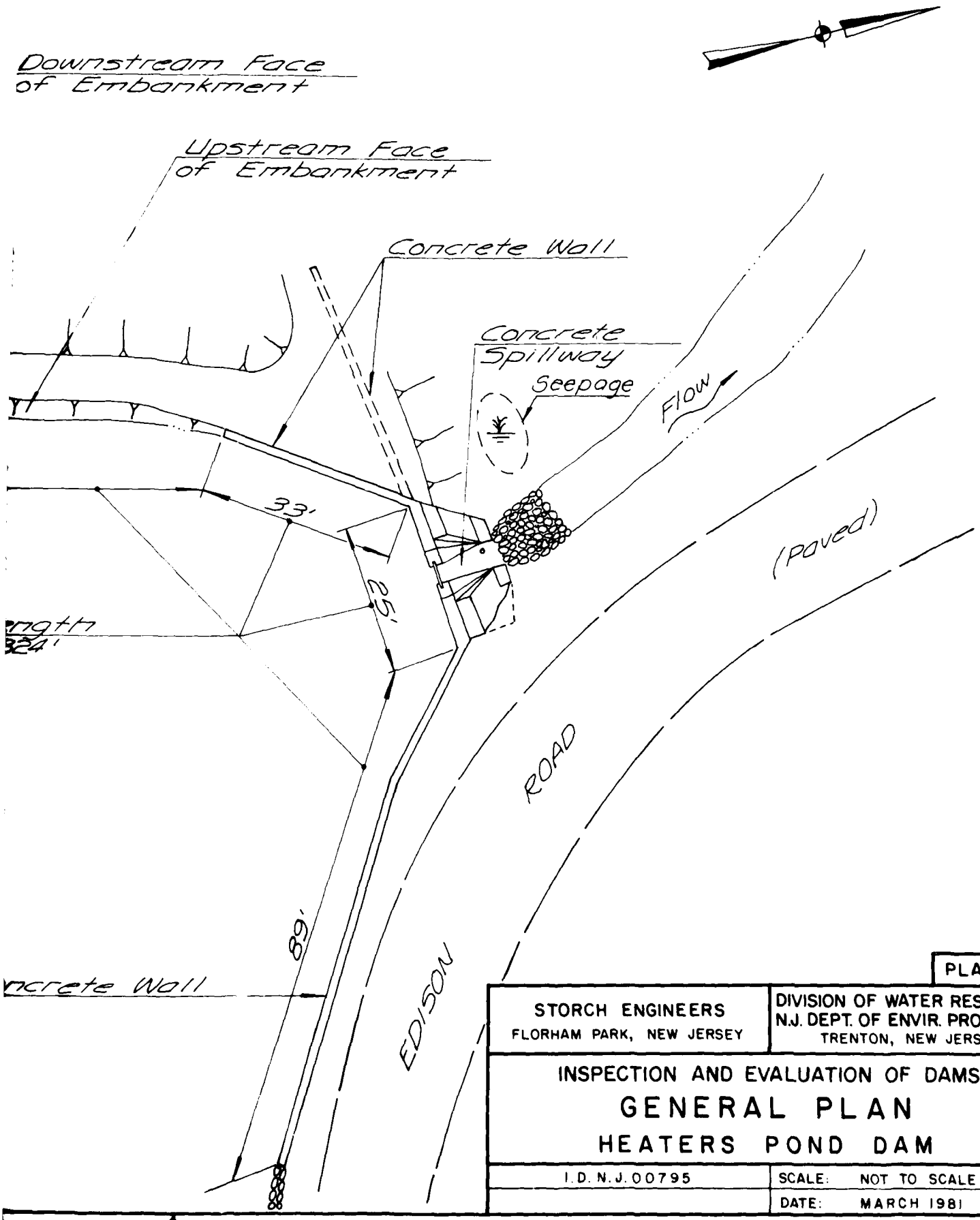


PLATE 4

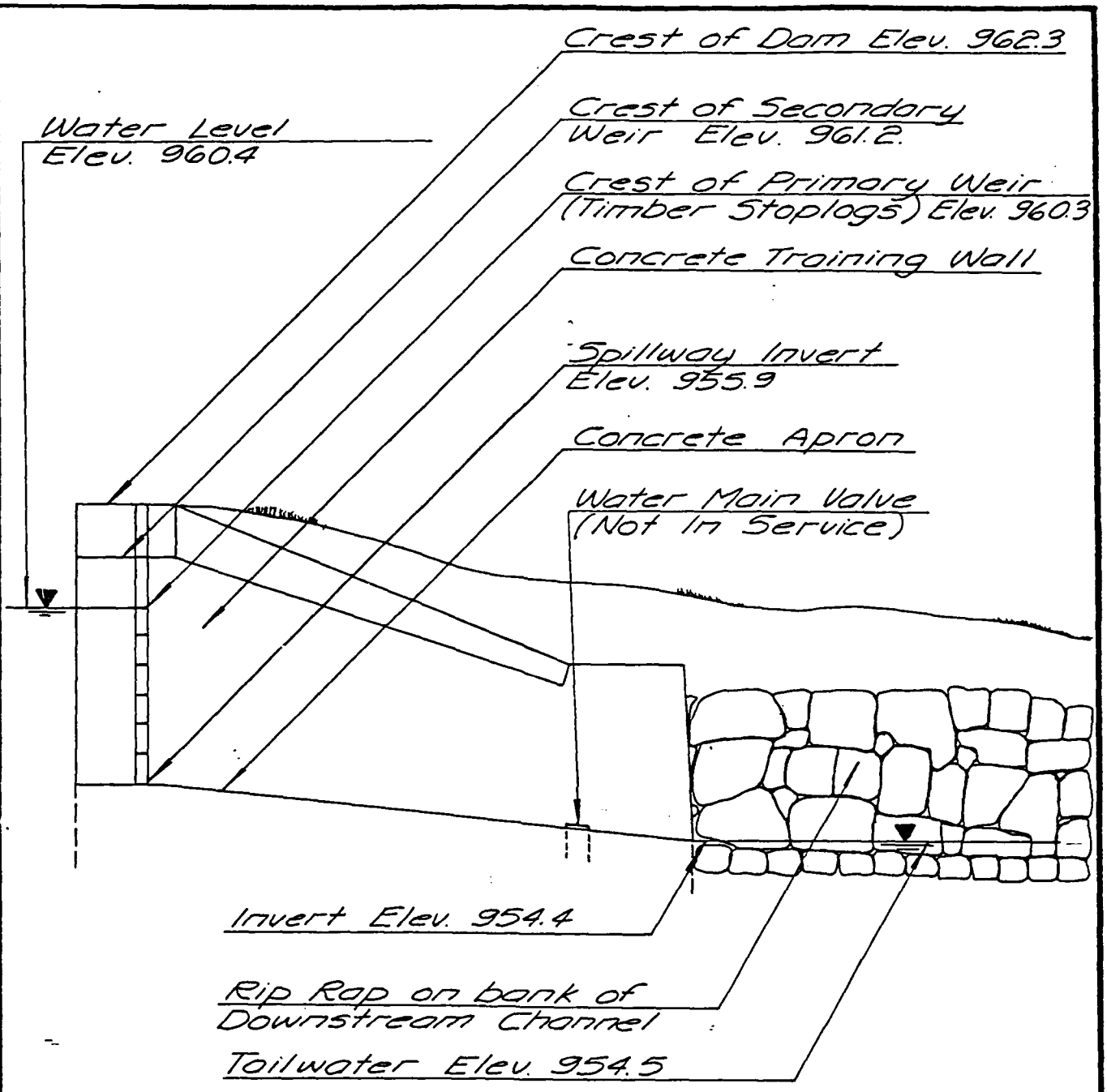
STORCH ENGINEERS FLORHAM PARK, NEW JERSEY	DIVISION OF WATER RESOURCES N.J. DEPT. OF ENVIR. PROTECTION TRENTON, NEW JERSEY

INSPECTION AND EVALUATION OF DAMS

GENERAL PLAN

HEATERS POND DAM

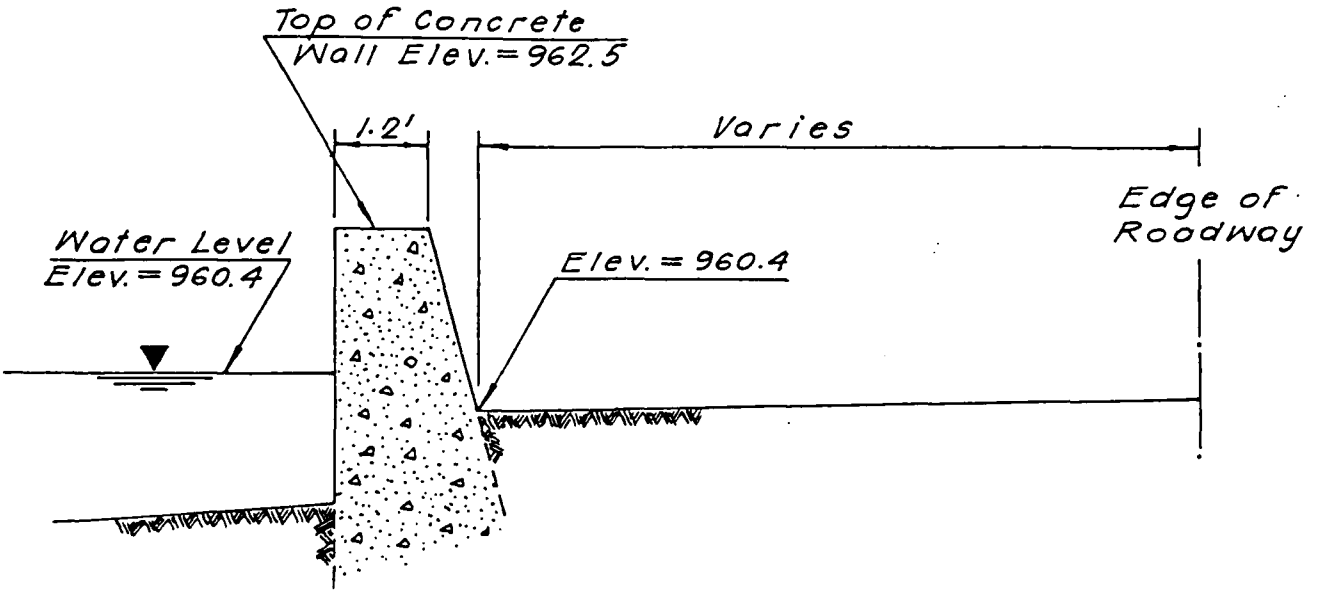
I.D. N.J. 00795	SCALE: NOT TO SCALE
	DATE: MARCH 1981



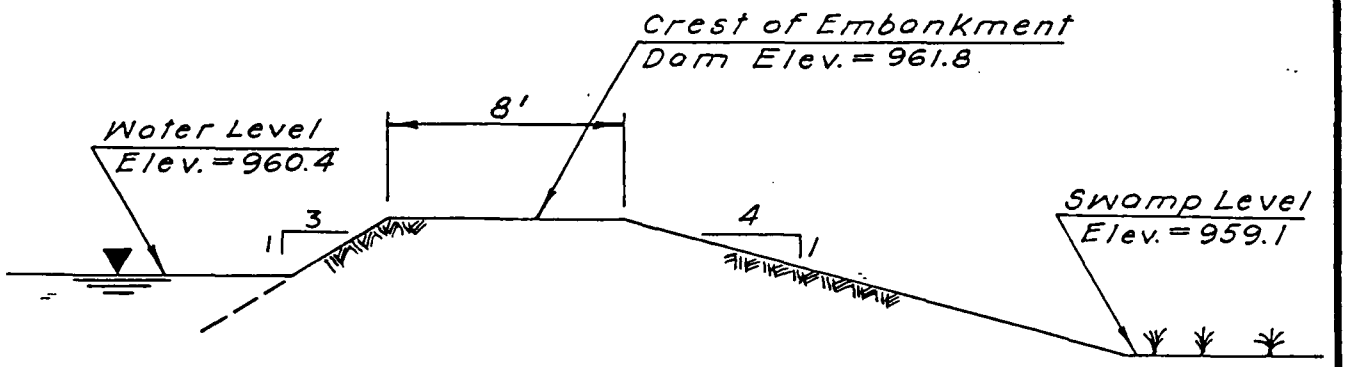
Note: Information taken from field Inspection December 24, 1980.

PLATE 5

STORCH ENGINEERS FLORHAM PARK, NEW JERSEY	INSPECTION AND EVALUATION OF DAMS SPILLWAY SECTION HEATERS POND DAM
DIVISION OF WATER RESOURCES N.J. DEPT. OF ENVIR. PROTECTION TRENTON, NEW JERSEY	I.D. N.J. 00795 | SCALE: NONE DATE: FEB, 1981



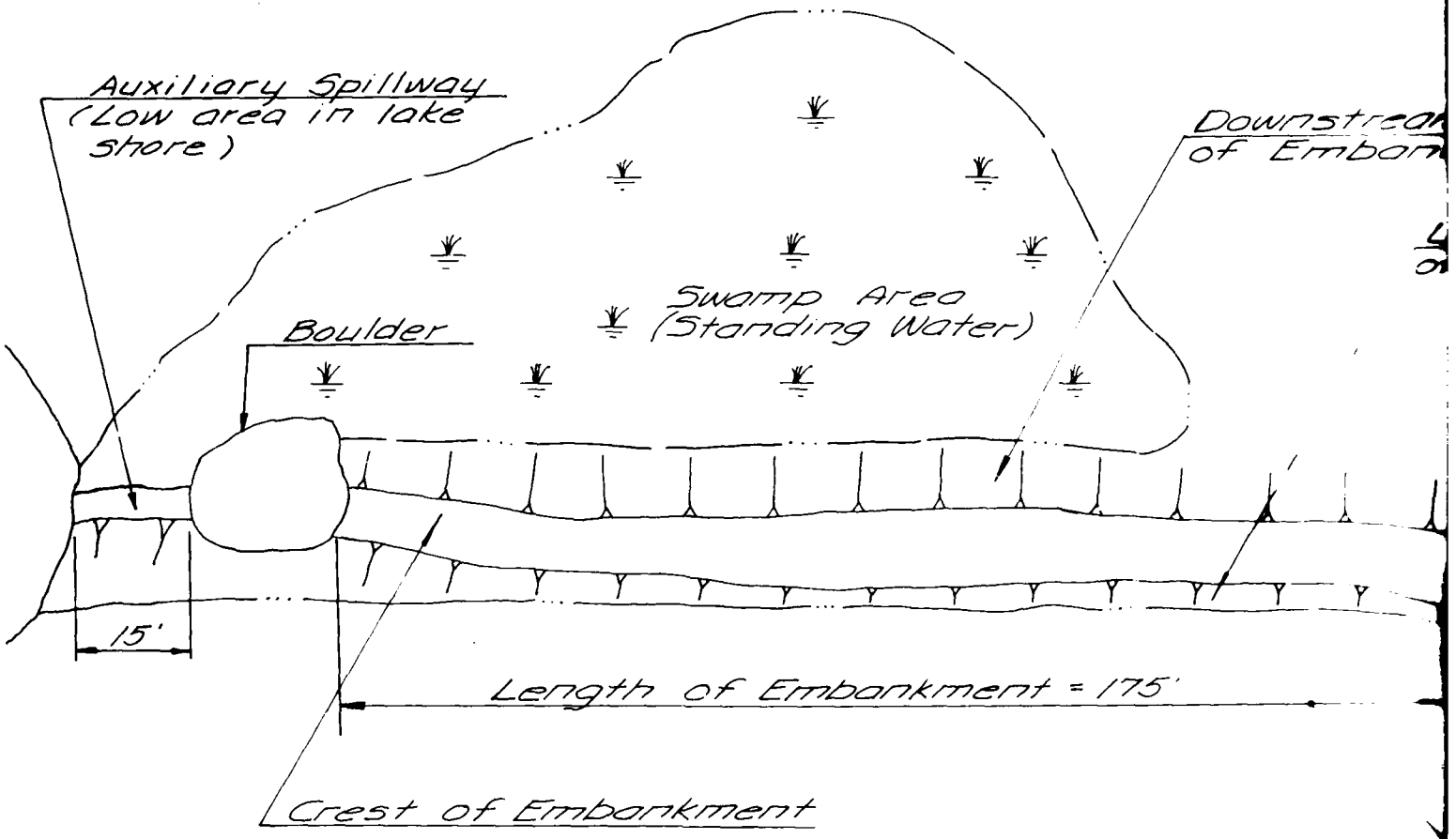
TYPICAL CONCRETE WALL DAM SECTION



TYPICAL SECTION EARTH EMBANKMENT

PLATE 6

STORCH ENGINEERS FLORHAM PARK, NEW JERSEY	INSPECTION AND EVALUATION OF DAMS SECTIONS HEATERS POND DAM
DIVISION OF WATER RESOURCES N.J. DEPT. OF ENVIR. PROTECTION TRENTON, NEW JERSEY	I.D. N.J.00795 / SCALE: NONE DATE: FEB.1981



Overall Length
of Dam = 324'

HEATERS POND

5

NOTE:
Information taken from plans titled "Heaters Pond Dam" prepared by Harold E. Pellow, P.E. & L.S. dated 8/21/79 and field inspection December 19, 1980.

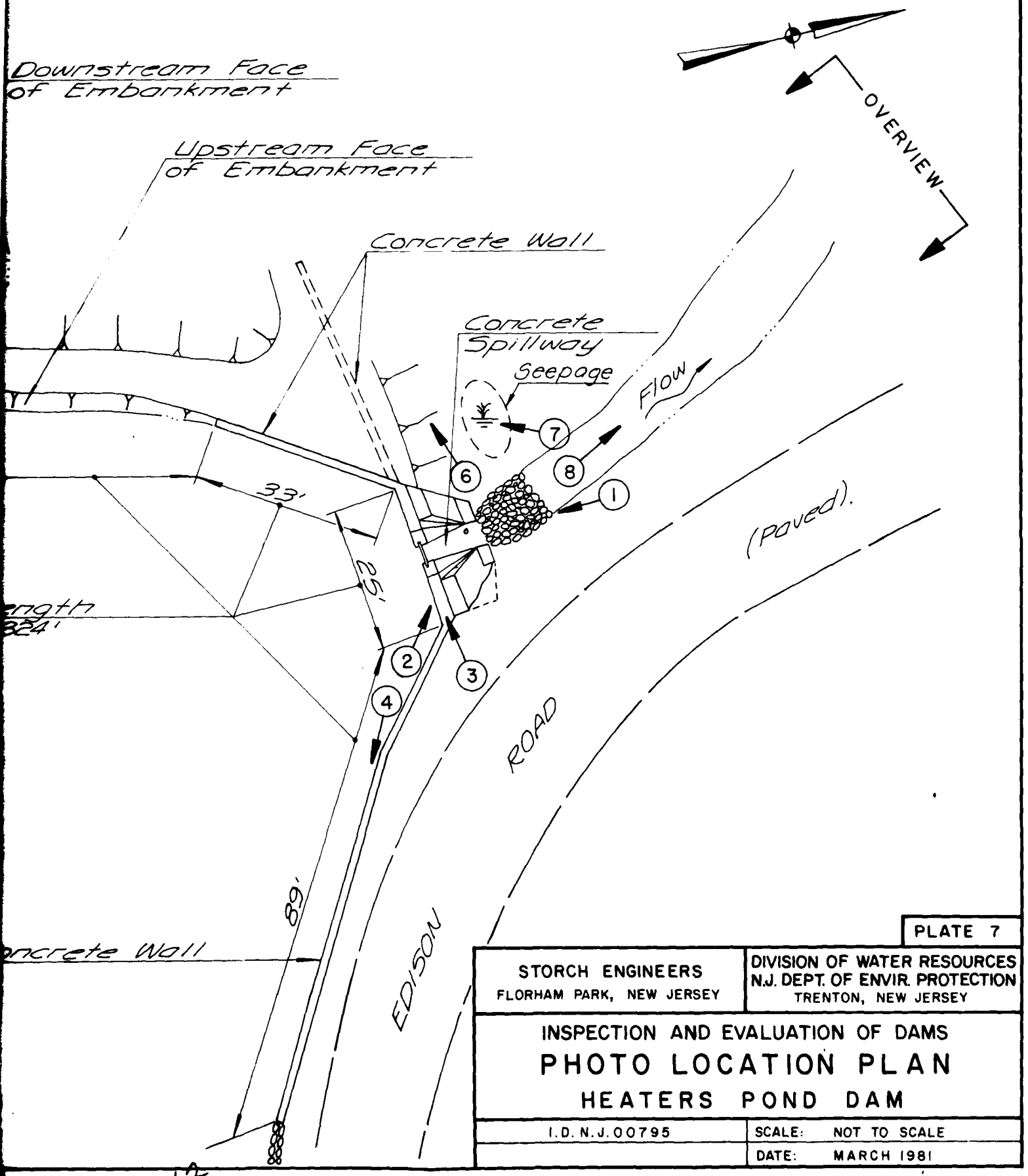


PLATE 7

STORCH ENGINEERS FLORHAM PARK, NEW JERSEY	DIVISION OF WATER RESOURCES N.J. DEPT. OF ENVIR. PROTECTION TRENTON, NEW JERSEY

INSPECTION AND EVALUATION OF DAMS

PHOTO LOCATION PLAN

HEATERS POND DAM

I.D. N.J. 00795	SCALE: NOT TO SCALE
	DATE: MARCH 1981

APPENDIX 1

Check List - Visual Inspection

Check List - Engineering Data

Check List

Visual Inspection

Phase I

Name of Dam Heaters Pond Dam County Sussex State N.J. Coordinators NJDEP

Date(s) Inspection 12/19/80 , 5/1/81 Weather P. Cloudy Temperature 20°F

Pool Elevation at time of Inspection 960.4 M.S.L. Tailwater at Time of Inspection 954.5 M.S.L.

Inspection Personnel:

John Gribbin William Carson

Charles Osterkorn Richard McDermott

Daniel Buckelew

John Gribbin Recorder

Owner's representative not present

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
GENERAL	Generally grass covered with some small trees and weeds on the upstream and downstream sides. Conc. wall along upstream face, right side in generally satisfactory condition.	Embankment obscured by snow at the time of inspection. Trees and adverse vegetation should be removed.
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Appeared stable	
ANY NOTICEABLE SEEPAGE	Area of standing water observed at toe adjacent to left side of downstream channel. Orange colored deposits in the water. Swampy area along toe of embankment near left end. Swampy area contained standing water some of which was not frozen (lake water was frozen.)	Observed possible seepage should be monitored on a periodic basis.
STAFF GAGE AND RECORDER	None observed	
DRAINS	None observed	

EMBANKMENT

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None observed	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None observed	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	None observed	
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Vertical: generally level. Horizontal: generally straight	
RIPRAP	None observed	Riprap observed in downstream channel.

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SURFACES IN OUTLET CONDUIT	Outlet works discharge through spillway.	Outlet works composed of stoplogs in spillway structure.
INTAKE STRUCTURE	N.A.	
OUTLET STRUCTURE	N.A.	
OUTLET CHANNEL	Same as spillway.	
GATE AND GATE HOUSING	Gate consists of timber stoplogs. Stoplogs appeared to be in satisfactory condition, although they were obscured by overflow at the time of inspection.	

SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
WEIR	Primary weir formed by stoplogs. Secondary weir formed by concrete spillway structure in good condition.	
APPROACH CHANNEL	N.A.	
DISCHARGE CHANNEL	Formed by downstream portion of spillway structure in good condition.	
APRON	Consists of bottom of spillway discharge channel - in good condition. Water valve cap observed protruding through apron - function unknown.	
AUXILIARY SPILLWAY	Irregularly formed earth channel flowing from lake shore to swamp area on downstream side of embankment.	Auxiliary spillway formed by low area in lake shore.

INSTRUMENTATION

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	None.	
OBSERVATION WELLS	None.	
WEIRS	None	
PIEZOMETERS	None	
OTHER		

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Shore slopes generally steep and wooded.	
SEDIMENTATION	Unknown.	
STRUCTURES ALONG BANKS	None observed.	

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTION, DEBRIS, ETC.)	In immediate vicinity of spillway channel was well graded and lined on bottom and both banks with limestone riprap. Stone size and placement appeared adequate. Channel then extends down side of mountain with narrow rocky flood plain resembling gorge.	
SLOPES	Side slopes rocky, wooded and very high - resembling gorge.	
STRUCTURES ALONG BANKS	Dwelling adjacent to channel about 800' downstream. Railroad bridge located about 1500' downstream. Road bridge (Rt. 517) about 3600' from dam. Several dwellings adjacent to channel 3600' to 7200' downstream from dam.	

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

ITEM			REMARKS
DAM	-	PLAN	Plans titled "Heaters Pond Dam" prepared by Harold E. Pellow, P.E. & L.S. dated 8/21/79. (5 Sheets) Harold E. Pellow Assoc. R.D. #1, Box 2D, Augusta, New Jersey, 07822.
		SECTIONS	
SPILLWAY	-	PLAN	Pellow plans
		SECTIONS	
		DETAILS	
OPERATING EQUIPMENT PLANS & DETAILS			N.A.
OUTLETS	-	PLAN	Pellow plans
		DETAILS	Pellow plans
		CONSTRAINTS	Not Available
		DISCHARGE RATINGS	Not Available
HYDRAULIC/HYDROLOGIC DATA			Not Available
RAINFALL/RESERVOIR RECORDS			Not Available
CONSTRUCTION HISTORY			Not Available
LOCATION MAP			Pellow plans

ITEM	REMARKS
DESIGN REPORTS	Not Available
GEOLOGY REPORTS	Soils report by Joseph Ward Associates for dam repair in 1979., available in Ogdensburg Borough Engineer's files (Pellow Assoc.)
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM INSTABILITY SEEPAGE STUDIES	Not Available
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	Not Available
POST-CONSTRUCTION SURVEYS OF DAM	Not Available
BORROW SOURCES	Not Available

ITEM	REMARKS
MONITORING SYSTEMS	Not Available
MODIFICATIONS	Embankment raised 3 feet and spillway modified in 1955 following hurricane. Reports not available. Repair of spillway in 1979. Plans by Harold Pellow available.
HIGH POOL RECORDS	Not available.
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	Not available.
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	Dam damaged during 1955 hurricane.. No report available.
MAINTENANCE OPERATION RECORDS	Informal maintenance reports on file with the Borough of Ogdensburg.

APPENDIX 2

Photographs

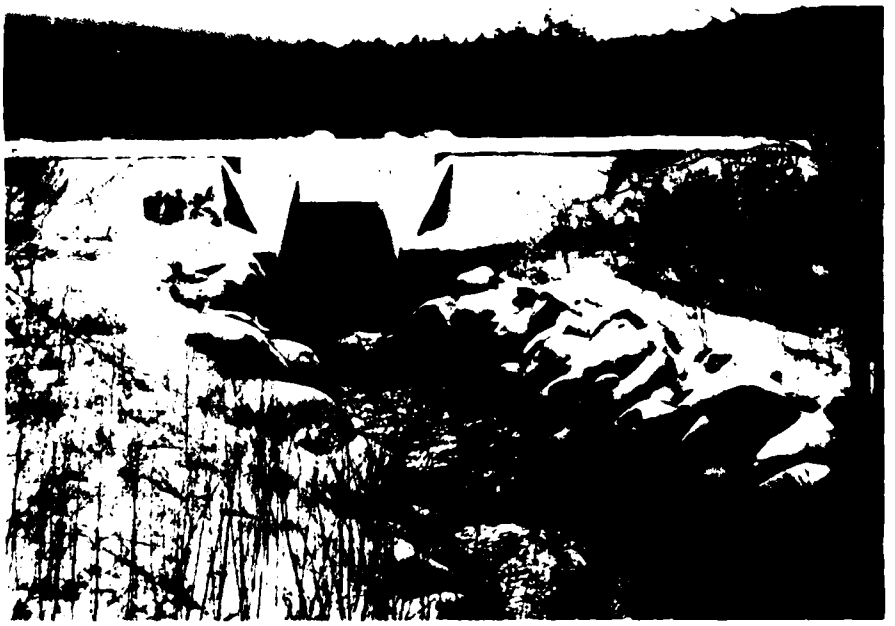


PHOTO 1

DOWNSTREAM SIDE OF SPILLWAY SHOWING RIPRAP ALONG DOWNSTREAM CHANNEL

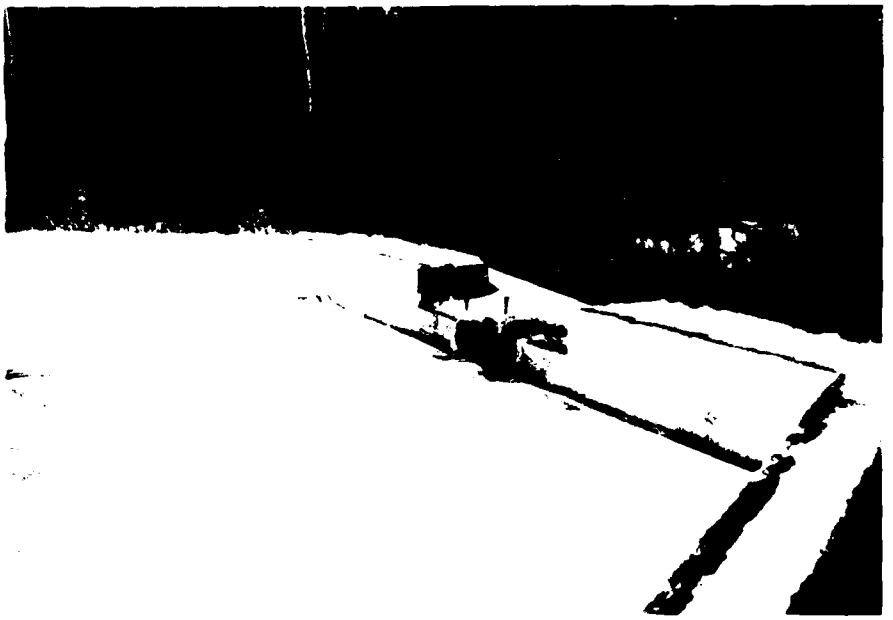


PHOTO 2

UPSTREAM SIDE OF SPILLWAY

HEATERS POND DAM
19 DECEMBER 1980

PHOTO 3

CREST OF SPILLWAY

PHOTO 4

CONCRETE WALL ALONG LAKE SHORE - RIGHT OF SPILLWAY

HEATERS POND DAM

19 DECEMBER 1980

20 JANUARY 1981

PHOTO 5

AERIAL VIEW OF UPSTREAM SIDE OF DAM

19 DECEMBER 1980

PHOTO 6

DOWNSTREAM FACE OF EMBANKMENT

HEATERS POND DAM

PHOTO 7

STANDING WATER AT DOWNSTREAM TOE OF DAM

PHOTO 8

DOWNSTREAM CHANNEL IN VICINITY OF DAM

HEATERS POND DAM

19 DECEMBER 1980

APPENDIX 3

Engineering Data

CHECK LIST

HYDROLOGIC AND HYDRAULIC DATA

ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: Wooded

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 960.4 (55 acre Ft.)

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): N.A.

ELEVATION MAXIMUM DESIGN POOL: 964.5

ELEVATION TOP DAM: 962.3

SPILLWAY CREST: Controlled Weir-Stoplogs (Primary) - Uncontrolled Weir (Secondary)

a. Elevation 960.3 (Primary), 961.3 (Secondary)

b. Type Sharp Crested Weir (Primary), Trapezoidal Section Weir (Secondary)

c. Width 0.1 Feet (Primary), 2.0 Feet (Secondary)

d. Length 3.1 Feet (Primary), 5.0 Feet (Secondary)

e. Location Spillover Upstream Side of Dam

f. Number and Type of Gates One Set of Stoplogs

OUTLET WORKS: (Primary Spillway)

a. Type Removable Timber Stoplogs

b. Location Upstream Side of Dam

c. Entrance Invert 955.9

d. Exit Invert 955.9

e. Emergency Draindown Facilities: Remove Stoplogs

HYDOMETEOROLOGICAL GAGES: None

a. Type N.A.

b. Location N.A.

c. Records N.A.

MAXIMUM NON-DAMAGING DISCHARGE:

(Lake Stage Equal to Top of Dam) 97 c.f.s. (including outflow over low area adjacent to dam)
52 c.f.s. (spillway alone)

APPENDIX 4

Hydraulic/Hydrologic Computations

STORCH ENGINEERS

Sheet 1 of 14

Project HEATER'S POND DAM Made By Ji Ha Date 2/20/81

Chkd By JG Date 2/24/81

HYDROLOGIC ANALYSIS:

INFLOW HYDROGRAPH FOR HEATER'S POND DAM WILL BE DEVELOPED BY HEC-1-DAM, USING SCS TRIANGULAR UNIT HYDROGRAPH AND ROUTED BY THE MODIFIED PULS METHOD.

DRAINAGE AREA = 1.35 SQ MI

INFILTRATION DATA:

DRAINAGE AREA IS MAINLY WOODED

USE: INITIAL INFILTRATION 1.5 IN

CONSTANT INFILTRATION 0.15 IN/HR

TIME OF CONCENTRATION:

[by SCS-TR-55]

	length [Ft]	slope [%]	velocity [Ft.s]
OVERLAND FLOW 1	5500	3.6	0.47
OVERLAND FLOW 2	1500	8.7	0.75

$$Tc = \left[\frac{5500}{0.47} + \frac{1500}{0.75}\right]\frac{1}{36.0}$$

$$Tc = 3.25 + 0.55 = \underline{3.8\ Hr.}$$

TIME OF CONCENTRATION:

[by Handbook of applied hydrology
Chow - Pg. 14-36]

$$Tc^{2.14} = \frac{2}{3} L\eta / \sqrt{S}$$

$$Tc^{2.14} = \frac{2}{3}\frac{(7000 \times 0.4)}{\sqrt{0.047}}$$

Tc = time of concentr. [Min]
S = slope [%]
η = 0.4 roughness coefficient
L = length of overland flow [Ft]

$Tc = 69$ min

$Tc = 1.15$ Hr

$$Tc^{2.14} = \frac{2}{3}\frac{(5500 \times 0.4)}{\sqrt{0.036}} = 66 \text{ min}$$

$$Tc^{2.14} = \frac{2}{3}\frac{(1500 \times 0.4)}{\sqrt{0.075}} = 31 \text{ min}$$

94 min

$Tc = 1.56$ Hr.

TIME OF CONCENTRATION:

[Design of small dams] Pg. 70

$$Tc = \left[\frac{11.9\ L^3}{H}\right]^{0.385}$$

$$Tc = \left[\frac{(11.9 \times 1.33)^3}{330}\right]^{0.385}$$

$Tc = 0.39$ Hr.

Tc - time of concentr. [Hr]

L - length of longerst water-course [Mi]

H - elevation diffreuce [Ft]

COMPUTER INPUT

FOR HEC-1-DAM INPUT USE

Tc = 3.0 Hr. LAG_T - 60 % Tc

LAG - 60% Tc = 1.8 Hr.

PRECIPITATION: [Design of small dams USDI, 1973]

From Fig. 15 Zone 6

PMP - 25 IN / 6.0 Hr. / 10 Sq mi

duration	% PMP
6	100
12	109
24	117

LAKE STORAGE VOLUME

WATER SURFACE ELEVATION [Ft]	AREA [Acres]
956.0	0
960.36	38.1
980.0	126.68
1,000.0	241.43

HEC-1 - DAM PROGRAM WILL DEVELOP STORAGE CAPACITY FROM SURFACE AREA AND ELEVATIONS

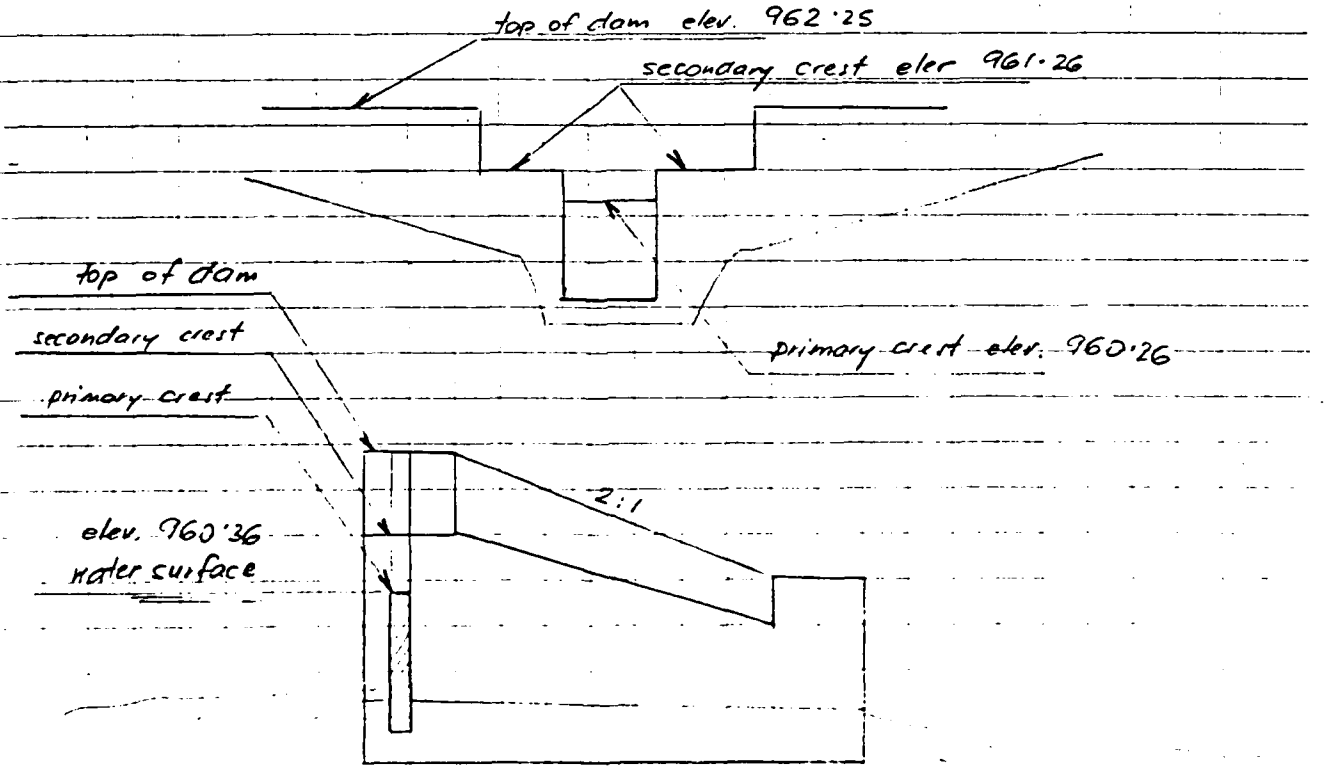
INFORMATION TAKEN FROM U.S.G.S. QUADRANGLE, FRANKLIN, N.J.

Project HEATER'S POND DAM Made By CLO Date 7/15/81

Chkd By JG Date 7/20/81

HYDRAULICS

THE SPILLWAYS AT HEATERS POND CONSISTS OF A FREE OVERFLOW TWO STAGE SPILLWAY AND AN IRREGULARLY SHAPED AUXILIARY SPILLWAY THE PRIMARY SPILLWAY IS A SHARP CRESTED WEIR. THE SECONDARY SPILLWAY IS A FREE OVERFLOW WEIR WITH A TRAPEZOIDAL CROSS SECTION. THE AUXILIARY SPILLWAY IS A BROADCRESTED WEIR FORMED BY A LOW AREA IN THE LAKE SHORE LOCATED AT THE LEFT END OF THE DAM.



THE PRIMARY CREST IS AT ELEV. 960.26 WITH AN EFFECTIVE LENGTH OF 3.1 FEET. THE SECONDARY CREST IS AT ELEV. 961.26 WITH AN EFFECTIVE LENGTH OF 5.0 FEET. THE TOP OF THE DAM IS AT ELEV. 962.25 WITH AN EFFECTIVE LENGTH OF 162.0 FEET. THE AUXILIARY SPILLWAY IS AT ELEVATION 961.16 WITH AN EFFECTIVE LENGTH OF 15 FEET.

DISCHARGE.

WILL BE CALCULATED USING THE FORMULA

$$Q = CLH^{3/2}$$

Q = discharge on crest [cfs]
C = coefficient of discharge
L = effct. length of overtopped crest [ft]
H = total head on spillway [ft]
* C_1 = coefficient of discharge for trapezoidal cross section

SPILLWAY STAGE DISCHARGE TABULATION

WATER ELEVATION (ft.)	PRIMARY CREST H (ft.)	C	Q (cfs)	SECONDARY CREST H (ft)	C	Q (cfs)	AUXILIARY CREST H (ft)	C	Q (cfs)	TOTAL Q cfs
960.26	—	—	—	—	—	—	—	—	—	0
961.26	1.0	3.32	10.3	—	—	—	0.1	2.6	1.2	11.5
962.25	2.0	3.32	29.1	1.0	3.0	22.5	1.1	2.6	45.0	96.6
963.26	3.0	3.32	53.5	2.0	3.22	45.5	2.1	2.6	118.7	217.7
964.26	4.0	3.32	82.3	3.0	3.22	83.5	3.1	2.6	212.9	378.8

STORCH ENGINEERS

Sheet 7 of 14

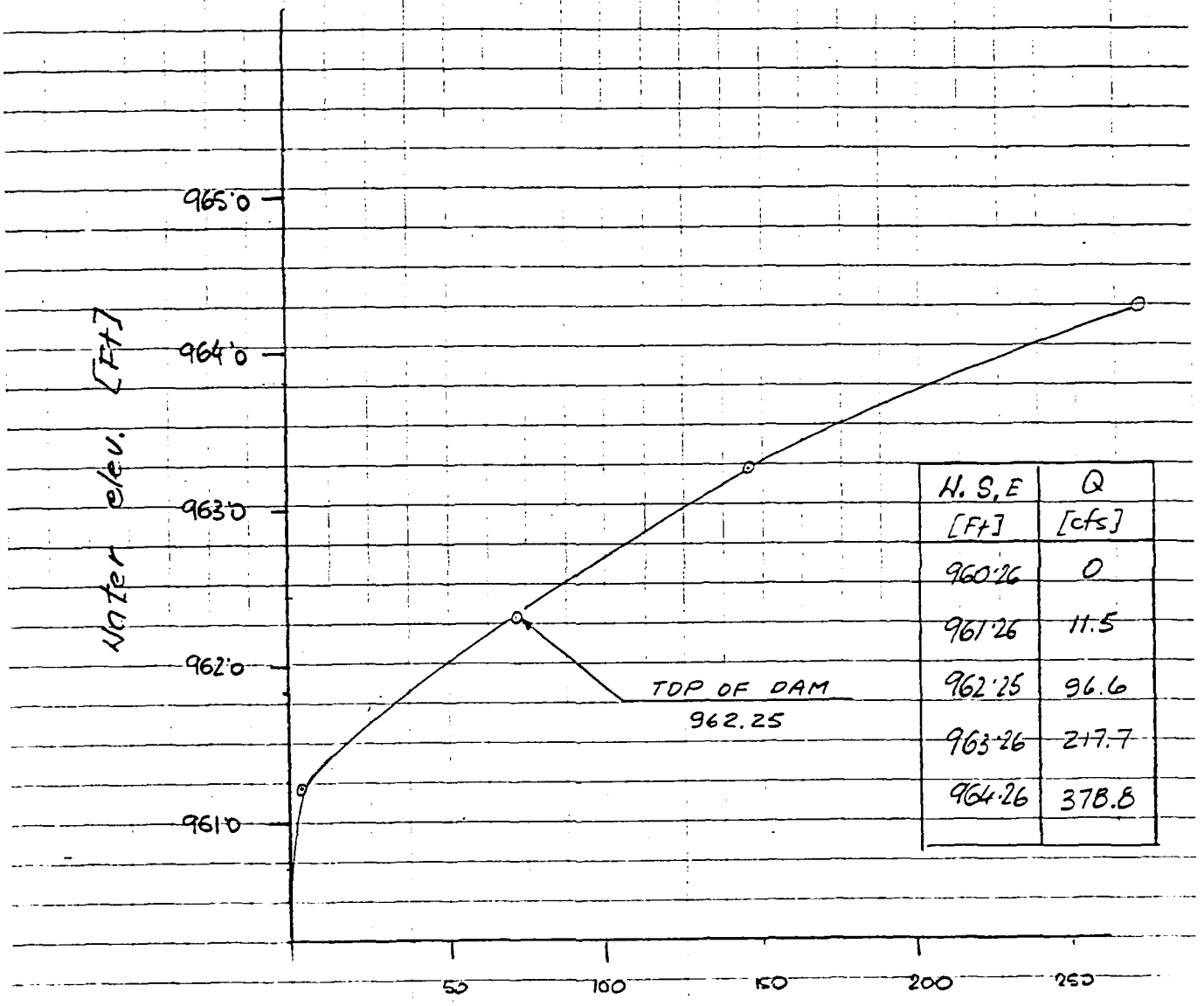
Project HEATER'S POND DAM

Made By CLO Date 7/15/81

Chkd By JG Date 7/20/81

SPILLWAY

STAGE DISCHARGE CURVE:



H. S, E [Ft]	Q [cfs]
960.26	0
961.26	11.5
962.25	96.6
963.26	217.7
964.26	378.8

STORCH ENGINEERS

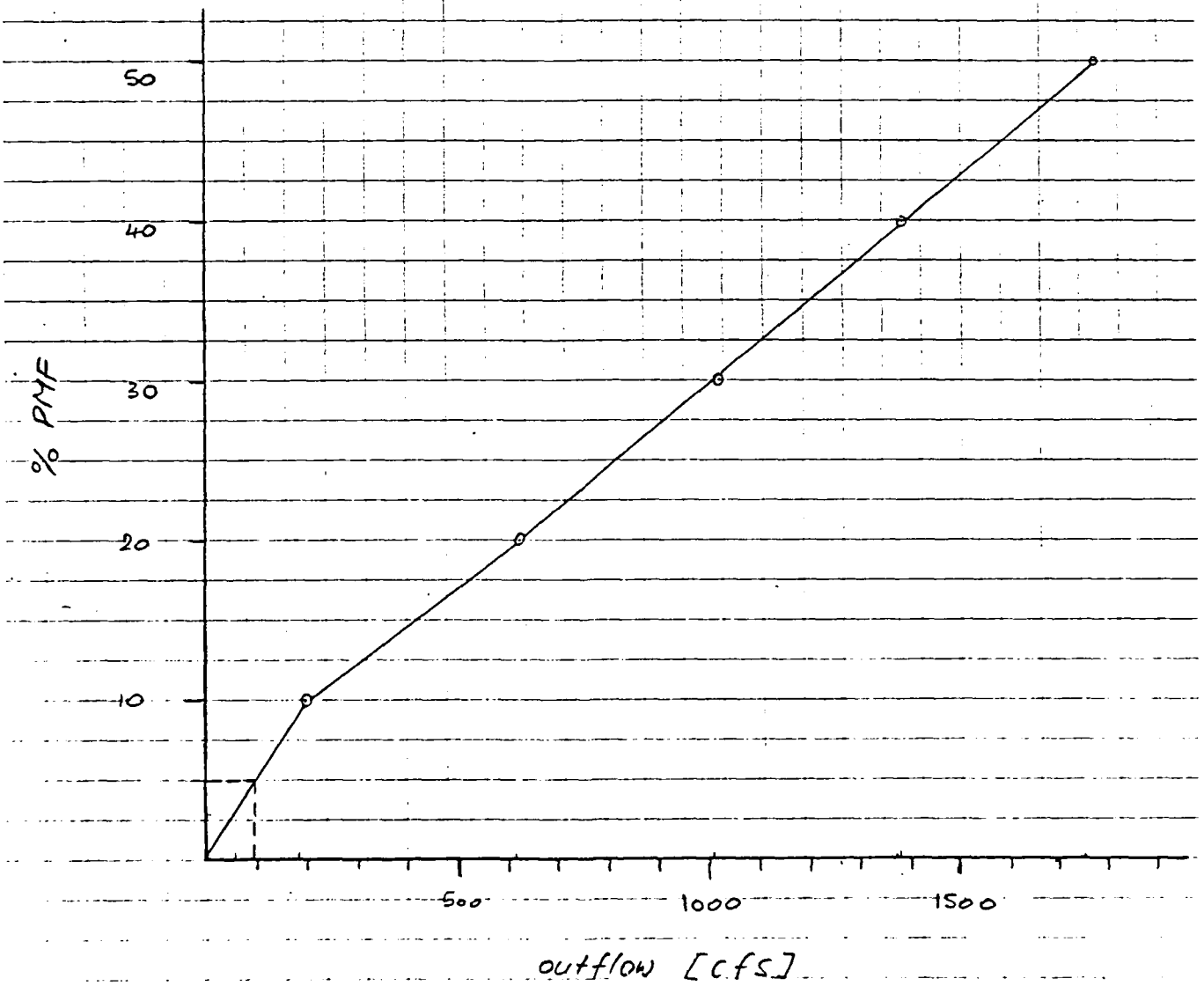
Sheet 8 of 14

Project HEATER'S POND DAM

Made By CLO Date 7/15/81

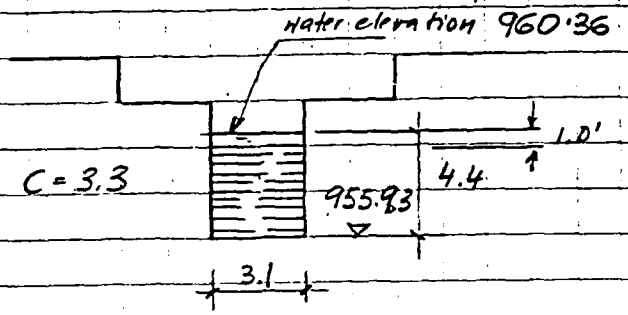
Chkd By JG Date 7/20/81

OVERTOPPING POTENTIAL:



OVERTOPPING OF DAM OCCURS AT ELEV. 962.25 [FT] WITH Q = 96.6 [cfs]. DAM CAN PASS APPROX. 5 % PMF

II d DRAWDOWN:



Spillway crest elevation = 960.26

Storage = 52 Acft.

$Q = CLH^{\frac{3}{2}} = 3.3 \times 3.1 \times 1^{3/2} = 10.23$ cfs

$T_d = \frac{\text{storage at spillway}}{\text{ave discharge} - \text{inflow}} = \frac{52 \text{ Acft}}{8.23 \text{ cfs}} = 3.2$ days

(Assume inflow = 2)

DRAWDOWN IS CALCULATED ASSUMING THE REMOVAL OF THE STOPLOGS FROM THE PRIMARY SPILLWAY IN 12-inch SECTIONS

STORCH ENGINEERS

Sheet 10 of 14

Project HEATER'S POND DAM Made By JHa Date 2/20/81

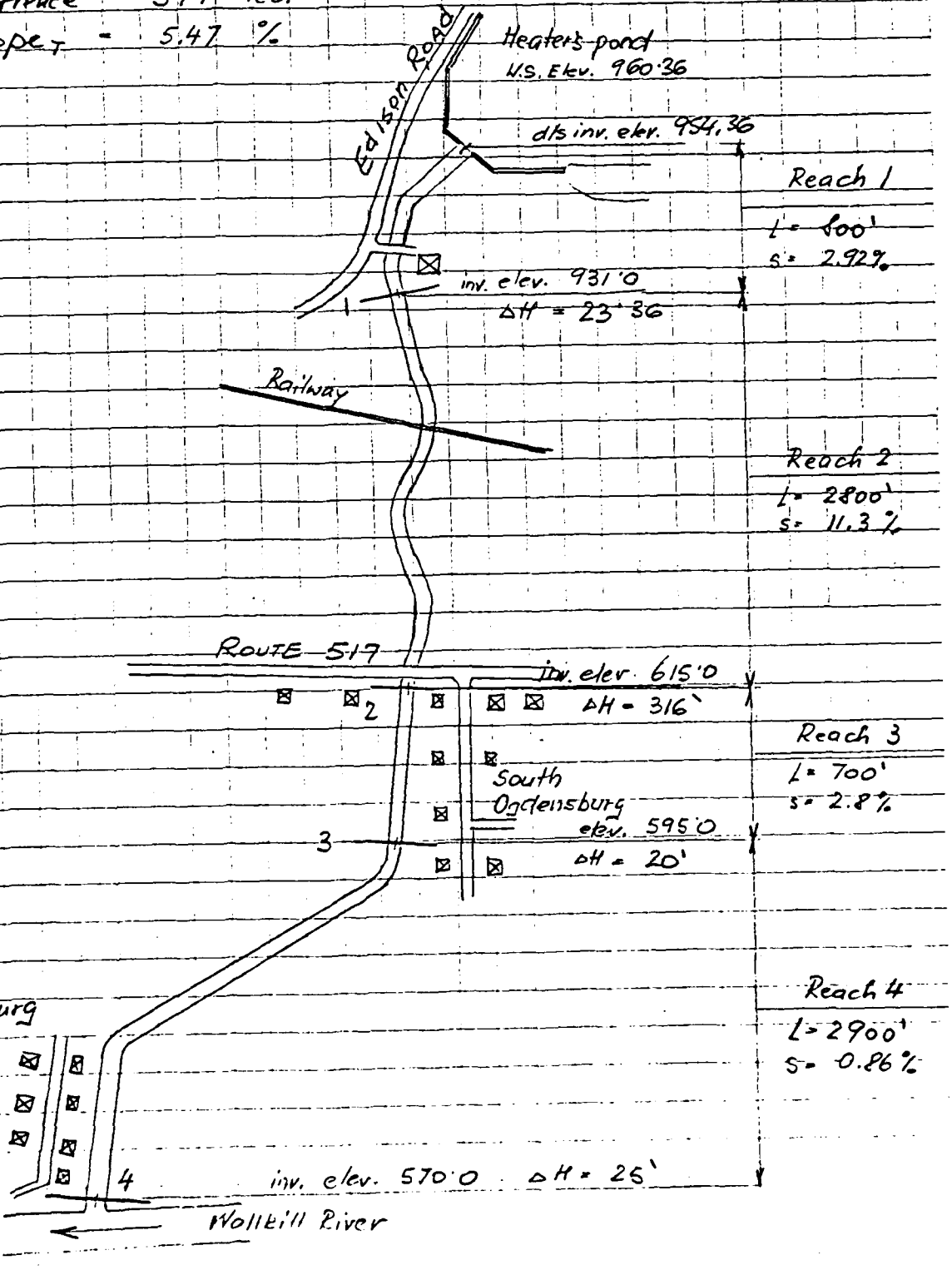
Chkd By JG Date 2/24/81

DOWNSTREAM CHANNEL

Length total - 7200 Feet

Elev. diffrence - 394 Feet

Ave. slope - 5.47 %



STORCH ENGINEERS

Sheet 11 of 14

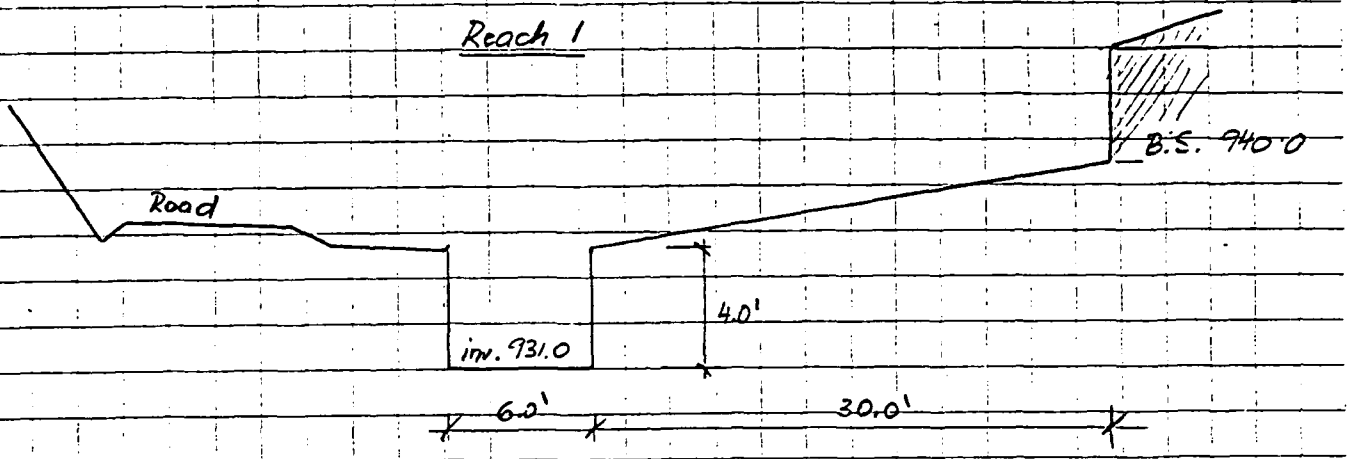
Project HEATER'S POND DAM

Made By J.H.G. Date 2/20/81

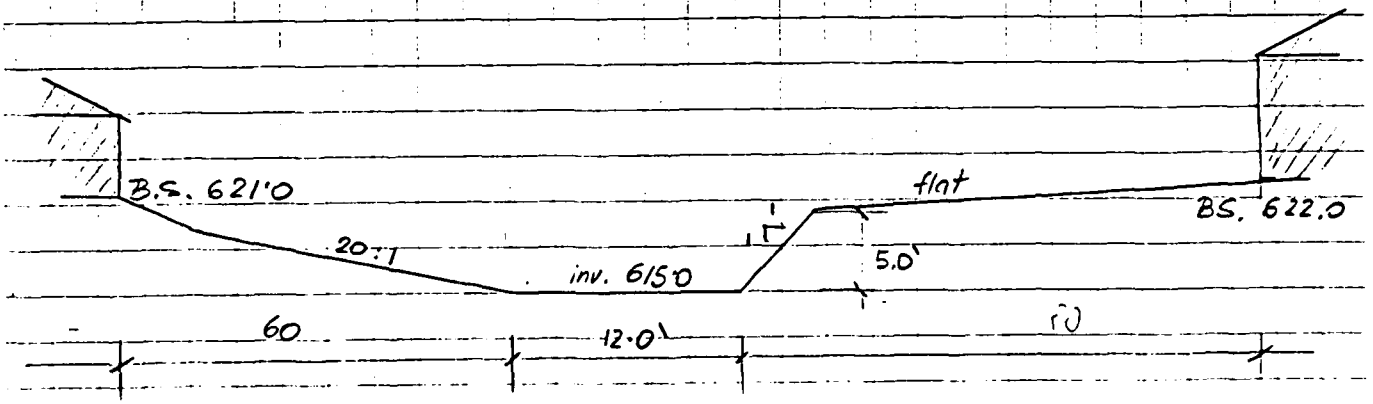
Chkd By JG Date 2/24/81

TYPICAL CROSS SECTION

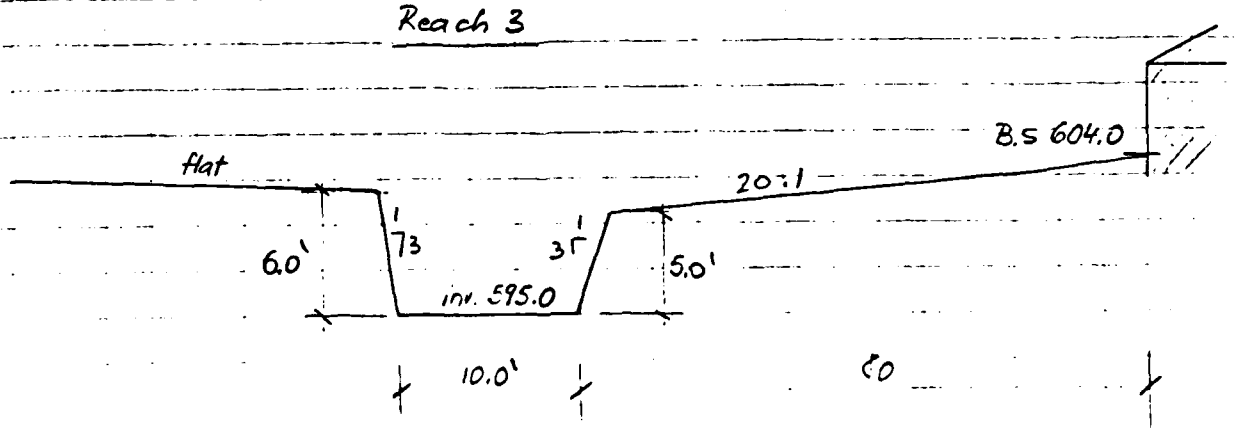
Reach 1



Reach 2



Reach 3



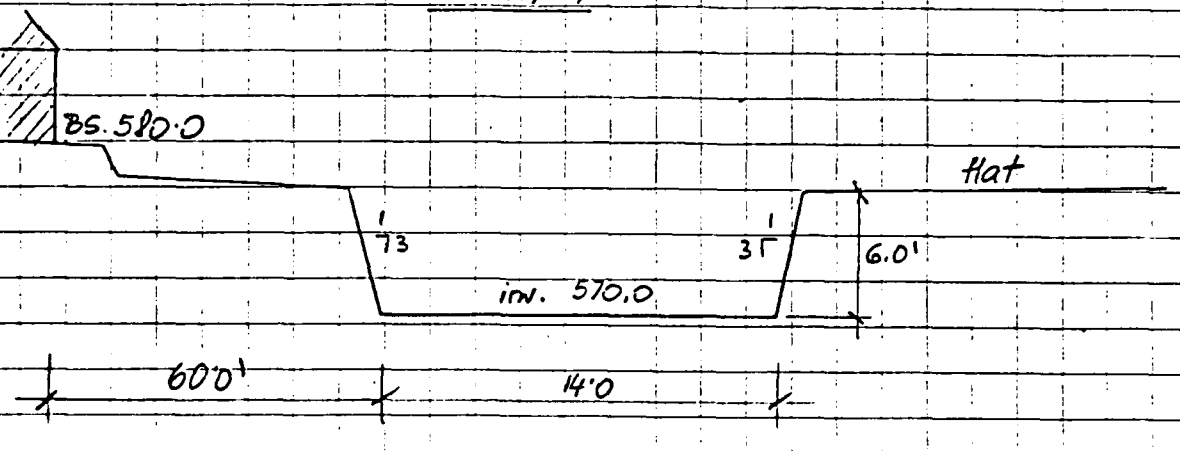
STORCH ENGINEERS

Sheet 12 of 14

Project HEATER'S POND DAM Made By J.Ha Date 2/4/81

Chkd By JG Date 2/24/81

Reach 4



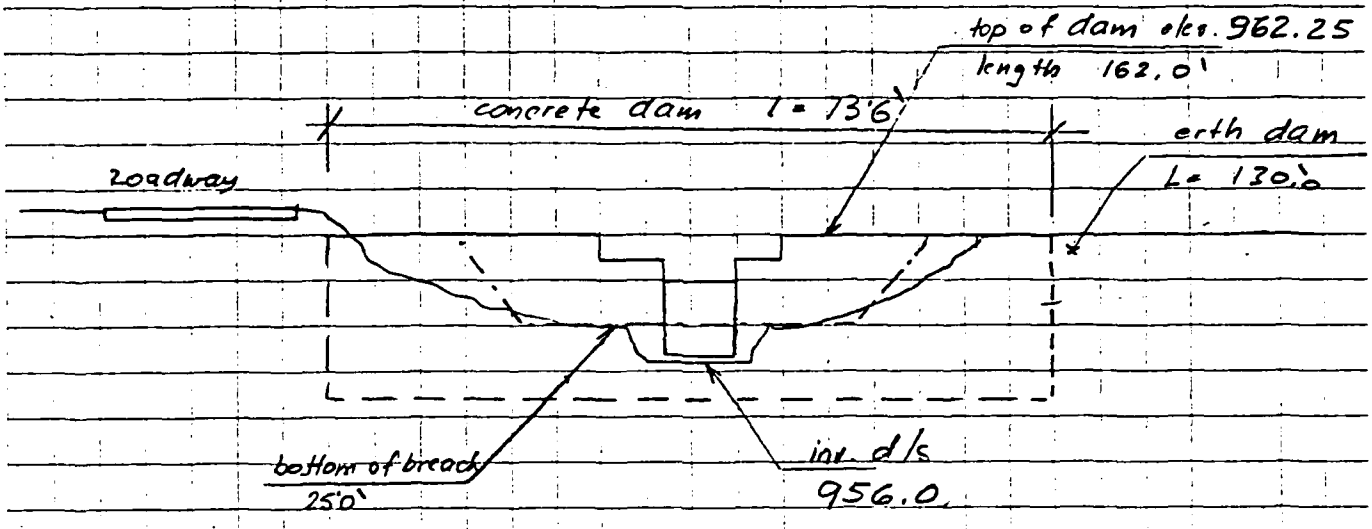
STORCH ENGINEERS

Sheet 13 of 14

Project HEATER'S POND DAM Made By CLO Date 7/15/81

Chkd By JG Date 7/20/81

BREACH ANALYSIS:



Width of bottom of breach := 73.6 x 0.33 = 25.0' [Ft]
(33% of concrete dam length)

Side slope of breach 1 : 1 = 1.0

Elevation of breach bottom = 957.36° [Ft]

Time for breach to develop max size = 1.0 [Hr]

Water surface elev. = 960.26 [Ft]

Water surface elev which will cause dam to fail = 962.0 [Ft]

BREACH RESULTS:

1. Peak outflow = 1807 cfs
2. Max. channel stage:
   Reach 1 - inv. elev. 931.0
   max stage elev. 951.2

- building will be inundated to a depth of approx. 11.0 feet.

Project HEATER'S POND DAM Made By CLO Date 7/15/81

Chkd By JG Date 7/20/81

Reach 2 - inv. elev. 615.0
max. stage elev. 618.1
- buildings will be not inundated

Reach 3 - inv. elev. 595.0
max. stage elev. 602.3
- building will be not inundated

Reach 4 - inv. elev. 570.0
max. stage elev. 578.9
- buildings will be not inundated

HEC - 1 - DAM PRINTOUT

Overtopping Analysis

```
IA1        NATIONAL DAM SAFETY PROGRAM
 A2        HEATERS POND DAM
 A3        MULTI RATIO ROUTING
 B    300          0       15                                    0       0       4
 B1     5
 J      1          5        1
 J1   0.5        0.4      0.3      0.2      0.1
 K      0     LAKE                          0       0        1
 K1         INFLOW HYDROGRAPH TO HEATERS POND DAM
 M      1          2     1.35                1.35       0
 P      0         25      100      109       117
 T                                                    1.5     0.15
 W2                1.8
 X   -1.0      -0.05      2.0
 K      1      DAM
 K1         ROUTE DISCHARGE THROUGH DAM
 Y                                      1         1
 Y1     1                                                -960.36      -1
 Y4960.26   961.26   962.25   963.26   964.26
 Y5     0     11.5     96.5    217.7    378.8
 $A     0     38.1   126.68   241.43
 $E   956   960.36    980.0   1000.0
 $$960.26
 $D962.25     2.54      1.5    162.0
 K      1        1                                        1
 K1         CHANNEL ROUTING 1
 Y                                      1         1
 Y1     1
 Y6  0.04     0.03     0.04    931.0    935.0      800   0.0292
 Y7     0    938.0        2    936.0        6    935.0        6   931.0       12   931.0
 Y7    12    935.0       42    940.0      112    945.0
 K      1        2                                        1
 K1         CHANNEL ROUTING 2
 Y                                      1         1
 Y1     1
 Y6  0.04     0.03     0.04    615.0    618.0     2800   0.113
 Y7     0    619.0       40    618.0       60    617.0       80   616.0       92   615.0
 Y7    97    620.0      117    621.0      137    622.0
 K      1        3                                        1
 K1         CHANNEL ROUTING 3
 Y                                      1         1
 Y1     1
 Y6 0.035    0.030    0.035    595.0    600.0      700   0.028
 Y7     0    602.0       20    601.5       40    601.0       43   595.0       53   595.0
 Y7    55    600.0       75    601.0      155    603.0
 K      1        4                                        1
 K1         CHANNEL ROUTING 4
 Y                                      1         1
 Y1     1
 Y6 0.035    0.030    0.035    570.0    576.0     2900   0.0086
 Y7     0    578.0       10    577.0       70    576.0       72   570.0       86   570.0
 Y7    88    576.0      108    577.0      128    578.0
 K     99
```

NATIONAL DAM SAFETY PROGRAM
HEATERS POND DAM
MULTI RATIO ROUTING

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
300	0	15	0	0	0	0	0	4	0

JOPER	NWT	LROPT	TRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 5 LRTIO= 1
RTIOS= .50 .40 .30 .20 .10

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

INFLOW HYDROGRAPH TO HEATERS POND DAM

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
LAKE	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	2	1.35	0.00	1.35	0.00	0.000	0	0	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	25.00	100.00	109.00	117.00	0.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .800

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.50	.15	0.00	0.00

UNIT HYDROGRAPH DATA
TC= 0.00 LAG= 1.80

RECESSION DATA
STRTQ= -1.00 QRCSN= -.05 RTIOR= 2.00

END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	23.40	19.63	3.77	70214.
										(594.)	(499.)	(96.)	(1988.24)

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

ROUTE DISCHARGE THROUGH DAM

ISTAO	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
DAM	1	0	0	0	0	0	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-960.	-1

STAGE	960.26	961.26	962.25	963.26	964.26
FLOW	0.00	11.50	96.50	217.70	378.80
SURFACE AREA=	0.	38.	127.	241.	
CAPACITY=	0.	55.	1589.	5209.	
ELEVATION=	956.	960.	980.	1000.	

CREL	SPWID	COOW	EXPW	ELEVL	COOL	CAREA	EXPL
960.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COOD	EXPD	DAMWID
962.3	2.5	1.5	162.

PEAK OUTFLOW IS 1771. AT TIME 18.00 HOURS

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 .50	RATIO 2 .40	RATIO 3 .30	RATIO 4 .20	RATIO 5 .10
HYDROGRAPH AT	LAKE	1.35	1	1909.	1527.	1146.	764.	382.
		(3.50)	(	54.06)(	43.25)(	32.44)(	21.63)(	10.81)(
ROUTED TO	DAM	1.35	1	1771.	1398.	1022.	625.	197.
		(3.50)	(	50.14)(	39.58)(	28.94)(	17.69)(	5.58)(
ROUTED TO	1	1.35	1	1770.	1397.	1022.	625.	197.
		(3.50)	(	50.13)(	39.56)(	28.94)(	17.69)(	5.58)(
ROUTED TO	2	1.35	1	1768.	1397.	1022.	625.	197.
		(3.50)	(	50.08)(	39.56)(	28.95)(	17.70)(	5.58)(
ROUTED TO	3	1.35	1	1768.	1398.	1023.	625.	197.
		(3.50)	(	50.06)(	39.58)(	28.96)(	17.69)(	5.58)(
ROUTED TO	4	1.35	1	1767.	1399.	1021.	623.	196.
		(3.50)	(	50.04)(	39.61)(	28.92)(	17.65)(	5.55)(

SUMMARY OF DAM SAFETY ANALYSIS

.....		INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
	ELEVATION	960.36	960.26	962.25
	STORAGE	55.	52.	133.
	OUTFLOW	1.	0.	97.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.50	964.47	2.22	240.	1771.	10.00	18.00	0.00
.40	964.11	1.86	222.	1398.	9.25	18.00	0.00
.30	963.72	1.47	202.	1022.	8.25	18.25	0.00
.20	963.25	1.00	179.	625.	6.75	18.50	0.00
.10	962.54	.29	146.	197.	4.00	19.50	0.00

PLAN 1 STATION 1

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	1770.	950.8	18.00
.40	1397.	946.8	18.00
.30	1022.	942.8	18.25
.20	625.	938.6	18.50
.10	197.	934.0	19.50

PLAN 1 STATION 2

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	1768.	618.1	18.00
.40	1397.	617.8	18.25
.30	1022.	617.5	18.25
.20	625.	617.2	18.50
.10	197.	616.5	19.50

PLAN 1 STATION 3

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	1768.	602.2	18.00
.40	1398.	601.1	18.25
.30	1023.	599.9	18.25
.20	625.	598.6	18.50
.10	197.	596.8	19.50

PLAN 1 STATION 4

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	1767.	578.7	18.25
.40	1399.	577.4	18.25
.30	1021.	575.9	18.25
.20	623.	574.3	18.50
.10	196.	572.1	19.50

HEC - 1 - DAM PRINTOUT

Breach Analysis

```
1A1        NATIONAL DAM SAFETY PROGRAM
 A2        HEATERS POND DAM
 A3        MULTI RATIO ROUTING
 B     300        0       15                                        0       0       4
 B1      5
 J       1        5        1
 J1    0.5      0.4      0.3      0.2      0.1
 K       0     LAKE                        0       0       1
 K1        INFLOW HYDROGRAPH TO HEATERS POND DAM
 M       1        2     1.35             1.35       0
 P       0       25      100      109      117
 I                                                          1.5     0.15
 W2              1.8
 X    -1.0    -0.05      2.0
 K       1      DAM
 K1        ROUTE DISCHARGE THROUGH DAM
 Y                                  1        1
 Y1      1                                          -960.36      -1
 Y4960.26  961.26  962.25  963.26  964.26
 Y5      0    11.5    96.5   217.7   378.8
 $A      0    38.1  126.68  241.43
 $E    956  960.36   980.0  1000.0
 $$960.26
 $D962.25    2.54     1.5   162.0
 $B   25.0       1  957.36     1.0  960 26   962.0
 K       1       1                                          1
 K1        CHANNEL ROUTING 1
 Y                                  1        1
 Y1      1
 Y6   0.04    0.03    0.04   931.0   935.0     800  0.0292
 Y7      0   938.0       2   936.0       6   935.0       6   931.0      12   931.0
 Y7     12   935.0      42   940.0     112   945.0
 K       1       2                                          1
 K1        CHANNEL ROUTING 2
 Y                                  1        1
 Y1      1
 Y6   0.04    0.03    0.04   615.0   618.0    2800   0.113
 Y7      0   619.0      40   618.0      60   617.0      80   616.0      92   615.0
 Y7     97   620.0     117   621.0     137   622.0
 K       1       3                                          1
 K1        CHANNEL ROUTING 3
 Y                                  1        1
 Y1      1
 Y6  0.035   0.030   0.035   595.0   600.0     700   0.028
 Y7      0   602.0      20   601.5      40   601.0      43   595.0      53   595.0
 Y7     55   600.0      75   601.0     155   603.0
 K       1       4                                          1
 K1        CHANNEL ROUTING 4
 Y                                  1        1
 Y1      1
 Y6  0.035   0.030   0.035   570.0   576.0    2900  0.0086
 Y7      0   578.0      10   577.0      70   576.0      72   570.0      86   570.0
 Y7     88   576.0     108   577.0     128   578.0
 K      99
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BA

HYDROGRAPH ROUTING

ROUTE DISCHARGE THROUGH DAM

ISTAO	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
DAM	1	0	0	0	0	0	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	=960.	=1

STAGE	960.26	961.26	962.25	963.26	964.26
FLOW	0.00	11.50	96.50	217.70	378.80
SURFACE AREA=	0.	38.	127.	241.	
CAPACITY=	0.	55.	1589.	5209.	
ELEVATION=	956.	960.	980.	1000.	

CREL	SPWID	COOW	EXPW	ELEVL	COOL	CAREA	EXPL
960.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COOD	EXPD	DAMWID
962.3	2.5	1.5	162.

DAM BREACH DATA

BRWID	Z	ELBM	TFAIL	WSEL	FAILEL
25.	1.00	957.36	1.00	960.26	962.00

BEGIN DAM FAILURE AT 15.00 HOURS

PEAK OUTFLOW IS 1807. AT TIME 18.00 HOURS

PEAK FLOW AND STORAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS				
				RATIO 1 .50	RATIO 2 .40	RATIO 3 .30	RATIO 4 .20	RATIO 5 .10
HYDROGRAPH AT	LAKE	1.35	1	1909.	1527.	1146.	764.	382.
		(3.50)	(	54.06)(	43.25)(	32.44)(	21.63)(	10.81)(
ROUTED TO	DAM	1.35	1	1807.	1445.	1218.	1158.	906.
		(3.50)	(	51.16)(	40.92)(	34.49)(	32.80)(	25.64)(
ROUTED TO	1	1.35	1	1804.	1450.	1199.	1143.	891.
		(3.50)	(	51.07)(	41.06)(	33.95)(	32.37)(	25.24)(
ROUTED TO	2	1.35	1	1809.	1445.	1220.	1116.	860.
		(3.50)	(	51.21)(	40.91)(	34.55)(	31.60)(	24.35)(
ROUTED TO	3	1.35	1	1811.	1442.	1225.	1123.	861.
		(3.50)	(	51.28)(	40.82)(	34.70)(	31.80)(	24.37)(
ROUTED TO	4	1.35	1	1806.	1442.	1227.	1138.	880.
		(3.50)	(	51.15)(	40.84)(	34.76)(	32.21)(	24.91)(

SUMMARY OF DAM SAFETY ANALYSIS

.....		INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
	ELEVATION	960.26	960.26	962.25
	STORAGE	52.	52.	133.
	OUTFLOW	0.	0.	97.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.50	963.13	.88	174.	1807.	4.92	18.00	15.00
.40	962.77	.52	157.	1445.	4.08	18.00	15.25
.30	962.54	.29	146.	1218.	2.60	16.75	15.75
.20	962.54	.29	146.	1158.	1.17	17.50	16.50
.10	962.19	0.00	131.	906.	0.00	18.75	17.75

PLAN 1 STATION 1

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	1804.	951.2	18.00
.40	1450.	947.4	18.00
.30	1199.	944.7	16.75
.20	1143.	944.1	17.50
.10	891.	941.4	18.75

PLAN 1 STATION 2

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	1809.	618.1	18.00
.40	1445.	617.9	18.00
.30	1220.	617.7	17.00
.20	1116.	617.6	17.75
.10	860.	617.4	18.75

PLAN 1 STATION 3

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	1811.	602.3	18.00
.40	1442.	601.2	18.00
.30	1225.	600.6	17.00
.20	1123.	600.3	17.75
.10	861.	599.4	19.00

PLAN 1 STATION 4

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	1806.	578.9	18.00
.40	1442.	577.5	18.00
.30	1227.	576.7	17.00
.20	1138.	576.4	17.75
.10	880.	575.4	19.00

APPENDIX 5

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